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No. 4—Heel-bug in the Thoroughbred Horse*

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Attention has recently been focused on heel-bug in the thoroughbred horse by its widespread occurrence in 1936 and by the questionnaire circulated to trainers and others by the Committee on Equine Research appointed by the Agricultural Research Council.

The disease is important to racehorse owners and trainers not only because of its direct effect on the performance of the animal but also because of the secondary conditions which may follow it and prevent the animal from appearing on a racecourse for weeks or months.

"Heel-bug" is used as a name for an eruption observed in the hollow of the heel and adjoining parts in horses in training. The eruption, as usually seen, consists of a number of tiny scabs or tetters. Removal of the scabs reveals little ulcers which exude a watery discharge. All four heels may be affected and, as is usual with any skin condition in the horse, white and flesh-coloured areas show a more severe reaction. The local effect of the disease is slight and while animals do not give any indication of the affection by pawing, scraping or stamping, they do frequently resent having the part handled and exhibit pain on pressure being applied.

The general result of the condition is that the animal's performance is affected. This may be attributed either to the discomfort of stretching the skin in the heels or to a slight malaise following absorption of toxins from the lesions.

The animal's ability to work is naturally more seriously affected when secondary infections occur. The penetration of the superficial layers of the skin of the heel provides a means of entry for the common pyogenic organisms as well as exposing the animal to the risk of more serious infections. Chronic lesions in the skin of the heels resembling cracked heels or grease may also occur.

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CAUSE

The cause of heel-bug is not established but there is some evidence in favour of a parasitic origin. The outstanding feature of the disease is its definite seasonal occurrence and the one point on which most people responsible for the care of the affected horses agree is that the trouble is picked up from the dewy grass on the gallops. The heel-bug "season" corresponds closely to the period of the year during which a little mite is widespread and active on the vegetation of the gallops. The mite, *Trombicula autumnalis* Shaw, commonly called the "harvest-bug" or "harvester," is known by the descriptive names of "orange tawny" in Ireland and "rouget" in France. It is a member of the family Trombiculinae, an irritating group which includes the North American "chigger" mites, the South American "Bicho Colorado," the Australian scrub-itch mites and the Japanese Akamushi which causes river-fever.

T. autumnalis is widely and irregularly distributed in the British Isles, being most prevalent in those chalky districts forming the Downs near which so many racing stables are established. In the late summer months the larvae are present in large numbers on the vegetation from which they transfer themselves to an animal host. The animal most commonly affected is the rabbit on which the mites are found, in August and September, all over the body, but especially on the under surface. In horses the mites are found in large numbers in the heels and they can be seen in clusters on the nose after grazing. They favour especially areas where the tissues are soft and comparatively hairless. The horses pick up the mites from the grass when at exercise. Dew or rain on the grass is an aid to infection, probably because the mites attach themselves more readily to wet feet and heels than to dry and dusty ones. Having become attached to some

part of the lower limb they proceed to the site of predilection, the heel, there producing the heel-bug lesions which may pass unnoticed unless the mites are present in large numbers.

The mites also attack human beings causing a severe irritation and sometimes a slight fever, the bites usually occurring where there is pressure from clothing. The mites are very small and, acting singly on the human body, they are rarely detected; but in animals they often occur in clusters and they are then seen as bright orange patches. They bury their mouth parts in the tissues of their host and remain feeding in that position for several days. When fully fed, usually in about three days, they drop off and further stages in their development probably take place in the soil. The fed larvae measure rather less than 1 mm. in length. The nymphal form of the mite has been seen on a few rare occasions and the adult is unknown. A few larvae can be found throughout the year externally parasitic on small mammals attached inside the ear or around the anus. Except for these isolated survivors the mite ceases to occur after the first autumn frost at which time heel-bug ceases to be a worry to the trainer.

Prognosis

Provided a case is attended early and one is given a free hand and there are no complications a cure in about a week's time can be anticipated.

Treatment

The mites remain in position for about three days so that if the animal is kept off the Downs and reinfection is prevented, treatment, after the first few days, need only be directed to healing the lesions which are the effect of the bites.

Treatment consists of a thorough washing of the part with mercurial soap, followed by a series of poultices. When the discharges have ceased a healing ointment is applied.

The following dressings have been found useful in practice: Neko soap (Parke Davis) containing 2 per cent. perchloride of mercury; Animalintex (Robinson) or boracic lint poultices, and Storaxol (Parke Davis) or zinc oxide ointment.

The leg from the fetlock down is thoroughly lathered with soap and hot water which is then rinsed off and the whole process repeated. This removes the dirt and grease from the skin and disinfects it, helping to avoid risk of secondary infections and mechanically removing some of the mites as well as having a parasiticide action on the remainder. The leg is then dried and a poultice is wrung out in very hot water and applied with a double layer in the hollow of the heel. The poultice is renewed twice a day for about three days. When there is no more discharge from the lesions the poultices are discontinued and the ointment is applied twice daily without bandaging. If possible the animal should be let down in diet for a few days and exercise should be restricted to leading out twice a day.

Prophylactic treatment is practically confined to the use of ointments, the same ointments being used for the treatment of milder cases. Among the many dressings used for these purposes the following may be listed:—

Ung. hydrarg.—mitis and fortis.
White precipitate ointment and the same ointment at double the official strength.
Lotio calaminae evap. (Willows'.)
Storaxol ointment.
Vetiod.

A solution of 2 per cent. Jeyes fluid and 2 per cent. paraffin in water has also been used as spray before exercise.

The white precipitate ointment is probably the most suitable preparation as it is parasiticide and is very soothing in its action on the horse's skin. The double strength ointment should not be used too freely for fear of poisoning from absorption.

Secondary infections are treated symptomatically with special emphasis on the local application of poultices until all discharges have ceased. Laxative and febrifuge treatment should be resorted to promptly.

Differential Diagnosis

There are so many skin conditions in horses with a special predilection for the heel that differential diagnosis from this condition is very important. The conditions that may be most easily confused with heel-bug are cracked heels, mud fever, eczema, grease and horse pox.

In cases of *cracked heels* and *mud fever* the lesions do not commence as little tetters but as linear separations of the skin usually following the horizontal folding lines caused by the movement of the joint. They are caused or encouraged by wet and cold and are more liable to occur in the winter months than at the period when heel-bug is prevalent, but cracked heels may follow heel-bug as a secondary condition, particularly if watery applications have been used frequently and the heels have not been carefully dried.

Acute eczema in the heel may closely resemble heel-bug, but there is usually, in the eczema, a more copious discharge with less tendency to dry into isolated tetters. The eczema presents a more diffuse lesion which is likely to spread out of the hollow of the heel to other parts of the limb. It frequently gives off a characteristic odour.

Grease differs from heel-bug in the chronic nature of its lesions, characterised by piling up of the layers of the epithelium as well as by its

discharges and its peculiar odour. In cases of heel-bug secondarily infected lesions closely resembling eczema and grease may be met with.

Horse-pox infection is almost always heralded by a period of indisposition while the lesions usually occur on the coronets and fetlocks as well as in the heels. Lesions may sometimes be found around the mouth and the perineal region. The lesions are definite variola vesicles up to 1 cm. in diameter and these burst, discharging a quantity of yellow serum. A large dry and very adhesive scab is then formed which is often very difficult to remove. In the heels the lesions may coalesce and give rise to a serious cracked heel. Lesions may also occur on the body.

Summary

The condition heel-bug, which occurs in thoroughbred horses in training in the late summer months, is described and, though proof is so far lacking, is considered to be due to the effects of a mite, *Trombicula autumnalis* Shaw, which is present on the gallops in large numbers at this time of the year, especially in chalky districts. A brief description of the mite and its life history is given. A method of treating heel-bug is described, especial emphasis being laid on the early use of hot poultices. The differential diagnosis from a number of similar conditions is discussed.

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The foregoing paper was the first of three short contributions which were considered by Congress at the session held in the Concert Hall of the Empire Exhibition, Glasgow, on the morning of Friday, September 9th, 1938, when Professor G. W. Weir, J.P., M.R.C.V.S., of Glasgow, presided over a large attendance of members and visitors.

The Chairman said that in introducing the contributor of the first paper, Dr. A. C. Fraser, of Lambourn, he had very little to say as many of those present would know Dr. Fraser far better than he did. All of them, no doubt, would have read the paper, and as Dr. Fraser had no remarks to make by way of introduction he would call upon Mr. Beaumont to open the discussion.

Discussion

Mr. J. W. Beaumont, M.R.C.V.S. (Louth): I should first of all like to extend my heartiest congratulations to Dr. Fraser on his very able and instructive paper. He has had to deal with a difficult subject. I appreciate the honour extended to me in being asked to open the discussion.

The disease has been studied by all of us in practice and a mutual discussion of it is bound to be beneficial. The subject is one that should absorb the interest of all the agricultural research workers of the world and amongst others for these reasons:—

(1) The absence of any known literature on the disease.
(2) Lack of knowledge of a subject of such vital importance to racing studs.
(3) The inadequate research on the subject.

It is one of those diseases which presents a trail of hopes and disappointments to trainers and owners with constant regularity each year.

Its presence makes itself felt by the sudden appearance of a mild inflammation accompanied by vesicles and ulcers and a degree of cellulitis in the heel of the thoroughbred during the process of training. Fortunately the condition clears up quickly and rapidly responds to simple treatment; the best treatment that I am able to recommend is powdered calomel dusted into the heel.

The laboratory gentlemen, from whom one usually seeks guidance in such matters, are varied in their opinions as to the cause of the disease and hold divergent views on the subject. While one school of thought says definitely that it is a streptococcus infection, another says that it is associated with the mange mite and acari in general, while yet another says that the disease is caused by a helminth infection, such as the larvae of Strongyles and other allied worms, which are always present in the manure. If any of these theories are correct, then obviously the procedure should be to practise preventive measures by paying strict attention to stable hygiene, by (1) thorough and regular disinfection of stables, (2) frequent changing of the bedding, (3) the avoidance of peat moss bedding in particular, where the eggs and larvae of these intestinal worms are likely to proliferate in the heat and moisture of the bedding.

The subject has been so ably presented to you that it only remains for me with you, and on your behalf, to congratulate Dr. Fraser on his concise and clear exposition of it, having supplemented it and amplified it as far as possible and so far as my own experience has brought me in contact with the problems associated with the disease.

Mr. E. L. Taylor (Weybridge) said that it was always interesting to have a new subject brought forward for a discussion as when that subject was a disease, to be discussed for the first time, there was a splendid opportunity for bringing

out alternative theories for the explanation of the condition, and the only thing which he had to contribute to the discussion on that subject was to suggest an alternative parasitic explanation for that condition.

When he was discussing that matter with Mr. Bosworth, of Cambridge, a few days previously, he gathered from him that heel-bug only occurred in horses which were exercised early in the morning while the dew was on the grass. Apparently many of the training stables of horses went out in two strings to exercise, one string going out first thing in the morning and the second string later when the dew was off the grass, and the heel-bug occurred only in the first string. Mr. Bosworth asked him if that occurrence might be associated with any worm larvae present in the dew on the grass.

There was a species of worm occurring in young horses called *Strongyloides*, the larvae of which climbed up the grass in the dew. Observations carried out at Weybridge showed that these larvae were very sensitive to dryness, exposure to dryness on a blade of grass for only a few hours being fatal to them. Those larvae also had the habit of penetrating the skin, and it seemed to him quite possible, therefore, that heel-bug might be caused by the penetration of those parasitic larvae into the skin, the larvae only being present when the dew was on the grass.

He did not know that any great detail had been worked out on the bionomics of the larval acari which were known as "harvest mites." He believed they belonged to several different species of mite and that some of them had actually recently been traced to certain definite species. It seemed to him reasonable to think that the larvae of an *Acarus* would find it very difficult to climb up wet grass and it was very possible therefore that the harvest mites were present in greater numbers on the grass when it was dry than when it was wet. It appeared to him, further, quite reasonable to suppose that if this condition were due to the harvest mite it should occur just as much in the horses which were exercised when the grass was dry as in those which were exercised when the grass was wet. He did not know whether Dr. Fraser agreed with that correlation of that dryness and wetness in the grass. If it was true that the condition only occurred in the horses which were exercised in wet grass he would like to ask Dr. Fraser for an explanation of that coincidence.

Major F. L. Gooch said that he would like to ask Dr. Fraser two questions. Did he know if any of the other parts of the body of the horse were affected with the so-called heel-bug, because his experience was that in the human subject the harvest mite affected the other parts of the body; also, were any grooms or other attendants affected by the harvest bug, because he thought one could not go even into any garden where the harvest bug was present without being bitten in any part of the body to which the mite had access.

The Reply

Dr. Fraser, in reply, said that he was sorry that more of them did not join in the discussion, but Professor Weir had explained to him that the condition was not met with largely in Scotland, so perhaps most of them had not seen it. He was very grateful to Mr. Beaumont for his kindly treatment of him in his opening of the discussion. As Mr. Beaumont had remarked, there was no known literature on the condition, and that had made it rather difficult for him (the speaker) to produce that paper, as he had to depend entirely on his own experience and the experience of a few veterinary surgeons whom he had been able to consult.

The Research Committee, through the Medical Research Council of the Privy Council, had set aside certain sums of money for research into that disease, and no doubt they would hear the results of their researches within the next twelve months or so.

He was sorry not to have heard more about the clinical condition met with by other practitioners: as he had said, he had had to depend upon his own observations. He must thank Mr. Beaumont for his powdered calomel treatment: he had not heard of that treatment before.

So far as other possible causes of the disease were concerned, there had been various organisms blamed for its causation. He had a laboratory report there on a smear sent up of a case of heel-bug, incriminating a non-haemolytic streptococcus, and the laboratory report concluded "tubercle bacilli were not found"—so that they could see that the causes of the disease had not been very thoroughly studied if tubercle bacilli were considered to be a possibility.

Mr. Taylor's suggestion of *Strongyloides* infection was, he realised, a serious rival to the harvest mite as a causative organism, although the definite seasonal occurrence of the disease was against this. He (Dr. Fraser) did not think it likely that the animals picked up the infection in the stable. That disease was practically confined to the thoroughbred horse; he thought that other horses were probably attacked by the infection, but they did not show the disease clinically because they were not in such an acutely sensitive condition. The disease occurred most commonly in thoroughbred horses in training: they were so carefully looked after in the way of picking up the droppings and keeping their bedding clean that they were not likely to contract infection from whatever it was that caused it, in the stable, though he agreed with Mr. Beaumont in condemning peat moss as bedding, because it was very difficult to keep such bedding clean.

In regard to Mr. Taylor's point about the first string of horses becoming infected more than the second string, he must say from personal experience that this was not the case. In one stable 69 out of 70 horses were affected: that meant the first lot, the second lot, and the odd horses. In racing circles it was generally agreed that the first lot of horses were more likely to contract the infection. If Mr. Taylor liked, he (Dr. Fraser) could collect some dew from the downs for him at the time when the first lot set out. That would also mean getting harvesters, because he was particularly susceptible to them. (Laughter.)

He understood Mr. Gooch to ask about other parts of the horse's body being affected. He had found the harvesters on heels and noses, but never on any other parts, and he had never actually seen clinical heel-bug infection except in the heels, although he was told by other veterinary surgeons that the disease might spread up the limb: in fact, one case was described to him as covering the whole of the hind limb. That might have been a case of heel-bug in the first place; he was inclined to believe that the spreading condition was probably of an eczematous nature, setting up an inflammatory condition over the rest of the limb. Other veterinary

Pyaemia in Foals Caused by *Corynebacterium equi*

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Since the publication in 1923 of my paper, "Specific Pneumonia in Foals. A New Pus-producer in the Horse," several reports of this form of infection have appeared in the literature. Unfortunately, however, a mistake has been made by several authors in that they have regarded the diphtheroid rod described by me, which I called *Corynebacterium equi*, as being identical with *Bacterium pyogenes*. Miessner and Wetzel had discovered in Hanover a bacillus similar to that described by me and they considered it to be identical with the one I described, although in fact it differs in several important aspects. Thus, they mentioned that it coagulated milk, peptonised coagulated horse serum, grew poorly on gelatin and as a rule required the addition of serum to the medium to be able to grow. A suggestion was made that the name given by me should be changed to *Corynebacterium pyogenes* (*equi*). Further, in this connection a survey was given of the most important literature dealing with *Bacterium pyogenes* (Grips, Künnemann, Glage and Nieberle) so that the impression was given that *Corynebacterium pyogenes* (*equi*) was a variant of that bacillus.

In the great work, "Handbuch der pathogenen Mikro-organismen," by Kolle and Wasserman (1929), in which the chapter on "Entzündungs und Eitèrerreger bei Haustieren" was written by Glage, this author includes in the section dealing with *Bacterium pyogenes* also the diphtheroid bacillus in the horse described by me, which is in fact a well-defined species. As Preisz had previously maintained that *Bacterium pyogenes* was a species of Corynebacteria and had suggested the name of *Corynebacterium pyogenes* for that species, it is easy to understand why the confusion arose, especially as Miessner and Wetzel had suggested the same name for the pus-producer in foals. Also in the new edition of Gaiger and Davies's "Veterinary Pathology and Bacteriology" (1938) and in Christiansen's "Bakteriologi och bakteriologisk teknik" (1932) the same confusion has been made. On the other hand, a correct description is given in Paul Haudu-roy's "Dictionnaire des bactéries pathogénes" (1937).

In order to try to rectify this mistake and also to supplement my first report I should like to give an account of what has appeared from the material investigated by me since 1922 from a stud of thoroughbreds and half-breds in which the disease has caused great devastation.

I consider this to be all the more important as I am of opinion that *Corynebacterium equi* is much more common than appears from the reports from different diagnostic laboratories. For it is probable that in cases of pyaemia in foals diphtheroid pyaemia has been confused with strangles or joint-ill, since streptococci and diplococci as well as coli bacteria are frequently present at the same time as *Corynebacterium equi*. Moreover, the last-mentioned organism is spherical or ovoid in shape and resembles a commonplace saprophyte in its mode of growth. Lütje and Schmiedhoffer have stated that they saw the same bacillus in foal abscesses but at that time considered it to be of no concern, and they classed it among the *prodigiosus*- or *pyocyaneus*-like contaminants.

Corynebacterium pyogenes and Corynebacterium equi: A Comparison

Everyone who has bacteriologically examined pus from horses and is acquainted with *Corynebacterium pyogenes*, or *Bacillus pyogenes*, as it is also often called (Poel's, Grip's, Künnemann's and Glage's bacillus), also described in detail by Holth, knows that this organism never occurs spontaneously as the cause of morbid processes in horses, while on the other hand it is very common in cattle and swine. Even experimentally the bacillus in question is non-pathogenic for horses. Its morphological, cultural and biological characters also differ so widely from those of the pigment-producing organism described by me that no confusion need ever take place. From the tabular classification given below it will be clearly seen that although both organisms belong to the group of Corynebacteria they nevertheless differ fundamentally from each other.

What I wish to emphasize is that the pus-producer in horses described by me has so many specific characters that it occupies as independent a position in the large group of diphtheroids or Corynebacteria as *Corynebacterium diphtheriae* in man, *Corynebacterium renale* in pyelonephritis in cattle or *Corynebacterium pyogenes* as a pus-producer in cattle and swine, and that it has very little affinity with the last-mentioned species.

surgeons had told him that a condition similar to heel bug might occur in the lower limbs outside the hollow of the heel.

He had never heard serious complaints from the grooms. Grooms were as a rule isolated from the ground, and when they were out at exercise in the early morning they were far enough away from the infection. In the human being the harvesters wandered all over the body, though they had some favourite sites; but, as he had said, he had only found the harvesters, assuming they were the cause of the disease, on the horses' noses and in the heels. He thanked them very much for the patient hearing they had accorded him.

	Corynebacterium pyogenes.	*Corynebacterium equi.*
Morphology.	Slightly Gram-positive, very thin rods. In pus plainly rod-shaped, several times as long as it is thick.	Obviously Gram-positive, large bacteria. In pus coccus-like or ovoid. In superficial cultures resemble streptococci. In broth and in deep colonies irregular rods, lying in V-formations, sometimes branched like streptothrix.
Cultures.	Optimum temperature 37° to 38° C.	Optimum temperature 18° to 37° C.
	Hardly any growth without the addition of serum to the broth, agar or gelatin. No growth on potato. No formation of pigment. Grows readily in milk with coagulation and a gradual peptonisation of the coagulum. On coagulated serum growth of small colonies, which by proteolysis form cavities after two to three days.	Abundant growth on all ordinary media with large succulent or mucous colonies of irregular shape, which assume a pale pink colour. In serum agar large colonies are visible already after one day, as vigorously developed at 20° as at 37° C. On potato, moist, thick growth, which soon takes on a pale pink colour, and afterwards turns a deep reddish yellow. Poor growth in milk, no coagulation. On coagulated serum a moist growth is visible after one day and becomes pinkish in colour after a few days. No proteolysis.
Biochemical Properties.	Decomposes the following fermentable substances: glycerin, glucose, galactose, fructose, mannose, saccharose, maltose, lactose, dextrin. Affects proteins. Milk, see above. Coagulated serum, see above. Acts on blood; haemolyses red blood corpuscles in both liquid and solid media.	Does not affect any fermentable substance. Has no effect on proteins. Does not affect red blood corpuscles. No haemolysis.
Biological Properties.	Produces suppurative processes in cattle, pigs, sheep, goats. Is also pathogenic for rabbits. Does not produce abscesses in lymph glands. Is not pathogenic for horses. Dies quickly in culture.	Most common in lung abscesses in horses. Pathogenic only for horses and swine and possibly for goats when injected by the subcutaneous route. Produces abscesses in lymph glands. Is able to remain alive for several years in liquid culture. Virulence remains unchanged after being kept for 15 years on media, transplantation being made once a year.
Production of Antibodies.	Gives rise to specific antibodies.	No agglutinins in spontaneously infected animals.

It is evident that the pus-producer in question belongs to the group of pseudodiphtheria bacteria, which comprises so many different species. In this respect it most closely resembles Hoffmann's bacillus, *Corynebacterium hoffmannii*, a micro-organism frequently found in the human throat when smear cultures are made for the isolation of diphtheria bacteria. It grows rapidly on most artificial media. Forms large succulent colonies on agar and serum. Does not affect carbohydrates. It is non-pathogenic for small experimental animals and does not produce toxins. It does not, however, belong to the chromogenic bacteria, as is the case with *Corynebacterium equi*.

Among the pyogenic bacteria in the horse described in the literature I have been able to find only one which resembles *Corynebacterium equi*, described above. In a nine-month-old equine foetus, showing multiple abscess-formation in the lungs and kidneys, Tor Stadler (1920) found a rod-shaped organism which he called *Bacillus foetalis equi*. It formed slimy colonies and developed rapidly at ordinary room temperature and at a temperature of 37° C. It did not ferment milk, grew on ordinary media without the addition of serum, did not peptonise serum, produced no haemolysins, and did not ferment any kind of sugar. It differed, however, from *Corynebacterium equi* in being Gram-negative and achromogenic. It was not pathogenic for rabbits, guinea-pigs or mice. No inoculation experiments on horses were performed. Morphologically it most closely resembles *Bact. coli*.

Among the diseases occurring in foals pneumonia forms a considerable proportion. Thus it has been found that of 744 cases of various kinds of diseases of foals examined by me 78

were cases of pneumonia. Of these 78 cases, 23, or nearly one-third, were caused by *Corynebacterium equi*. The different groups of diseases are summarised in the following table.

SURVEY OF CASES OF DISEASES IN FOALS EXAMINED AT MALMÖ DURING THE PERIOD 1915-1937

	Number of Cases	*Percentage*
Joint-ill	497	67
Tetanus	2	0·3
Other infections	22	2·95
Pneumonia	78	10·5
(23 being cases of diphtheroid pyaemia)		
Digestive disorders ..	28	3·8
Liver Affections	16	2·1
Worm Aneurysm	42	5·6
Other Visceral Diseases ..	15	2·0
General Debility	44	5·9
Total ..	744	

HISTORY OF CASES

(1) 920/23. Lungs and heart of a foal, three months old. The right apical lobe was diffusely consolidated. Three abscesses, varying from the size of a pea to that of a hazelnut, were found in the left lung and four similar abscesses in the right lung. The bronchial lymph glands were as large as hens' eggs with pus cavities, the size of hazelnuts. The bronchi contained greyish red mucus and pus. Cultures were made from the bronchial mucus, the lung abscess and from three lymph glands. Abundant growth of *Corynebacterium equi* in pure culture was obtained from all sites.

(2) 1183/23. The foal was born on May 11th and vaccinated on July 17th with 10 c.c. of corynebacterial vaccine. On August 8th it was found to be in a poor condition and showed signs of pulmonary affection. The animal died on August 26th.

The heart and lungs were sent in for *post-mortem* examination. One of the bronchial lymph glands was twice the size of a man's fist. The left lung showed no changes from the normal. The whole of the right lung was condensed with small abscesses in the lobus intermedius. The bronchi contained yellowish-grey pus. Pure cultures of *Corynebacterium equi* were obtained from two different lymph glands. Abundant growth of streptococci and a few colonies of *Corynebacterium equi* were obtained from a part of the indurated lung and from an abscess in the lobus intermedius.

(3) 780/24. Carcase of a foal two to three months old. No fluid was found in the pleura or pericardium. Complete consolidation was present in the apical and cardiac lobes. Two abscesses were found in the right lung and three in the left lung. A small quantity of pus was present in the bronchi. The contents of the abscesses were greyish-red in colour. The lymph glands were not greatly enlarged; on the other hand, the spleen was much larger than normal. The joints showed no abnormality. *Corynebacterium equi* in pure culture was obtained from five different abscesses. Cultural experiments with material from the kidney, the spleen and the lymph glands gave negative results.

(4) 988/24. Specimens of the organs of a foal about three months old, comprising the head, lungs and intestines with a large mesenteric lymph gland. In the lungs were found numerous thin-walled abscesses, which contained greyish-red, smeary pus. Both eyes showed changes. The corneas were opaque. The changes were most intense in the right eye. A yellow coagulum partially filled the anterior eye-chamber. The lens was partly detached. The pupil aperture of the left eye was covered with fibrin, and the vessels of the iris were extremely congested. The lungs showed numerous thin-walled abscesses containing greyish-red pus. In the root of the mesentery there was a collection of lymph glands as large as a child's head and they contained large abscesses (*see* fig. 3). In the mesentery close to the intestine there was a new growth, the size of a man's fist, composed of various walnut-sized caseous abscesses. In the wall of the small intestine belonging to that portion proximate to this abscess was seen an inflammatory, dark red area, which rose above the surface of the intestine. On section an ulcer was observed in the mucous membrane itself. The bottom of the ulcer consisted of a firm white necrosis (*see* fig. 4). Microscopically *Corynebacterium equi* was seen in pure culture in the right eye and in the necrotic, submucous portion of the intestine. In some of the lung abscesses *Corynebacterium equi* was found in association with putrefactive bacteria, also in the abscesses in the lymph glands. The cultures showed a pure growth of *Corynebacterium equi* from two lung abscesses.

(5) 574/25. Carcase of a foal, about three months old. Putrefaction had commenced. No pleuritis. Both lungs showed catarrhal consolidations. The cut surface was greyish-red in colour, with here and there small foci of consolidation. In the right lung there was a walnut-sized abscess. No pleurisy was present. The bronchial lymph glands were as large as walnuts with liquefaction, containing green, partly caseous, pus. Cultures were made from two places in the lung and from two lymph glands. *Corynebacterium equi* in pure culture was obtained from one of the lymph glands. In the other cultures the growth was not pure.

(6) 591/25. Case of a three-month old foal. No changes were observed except in the lungs. No pleuritis. The lymph glands at the root of the lung were enlarged to about the size of a walnut. They showed no liquefaction. No abscesses were found, but the cut surfaces of the lymph glands were greyish-red in colour and yielded an abundant, juicy scraping. The anterior parts of the lungs were completely consolidated and the cut surface was chocolate or liver-like in colour. In the left lung there were two abscesses and there was one abscess in the right lung (*see* fig. 5). These abscesses contained greyish-red pus. Cultures gave pure growth of *Corynebacterium equi* from the consolidated lung tissue, from a lung abscess and from a lymph gland.

(7) 602/25. Carcase of a foal, a little more than three months old. Serous pericarditis was noted, but no pleurisy. All lymph glands along the root of the lung and in the mediastinum were as large as walnuts or hens' eggs. The cut surface was moist and yielded a purulent scraping. In the left lung there were four bronchopneumonic foci with small pus-filled cavities. In the right lung three abscesses were seen. The liver was greatly enlarged. The cut surface resembled the markings of a nutmeg. At the root of the mesentery there was an abscess as large as a man's fist and another abscess, the size of a hen's egg, was seen farther towards the periphery of the mesentery close to the intestine. The contents of both abscesses were caseous with thin, greenish pus in the centre. Cultures were made from the kidneys, the liver, the bronchial pus, bronchial lymph glands and mesenteric lymph glands. Pure cultures of *Corynebacterium equi* were obtained from the mesenteric lymph glands. In the bronchial lymph glands there were also long streptococci. Coli bacteria were also isolated from the bronchial pus. No growth was obtained from the kidneys or liver.

(8) 1046/27. Carcase of a foal five weeks old. The animal had become ill when one week old. It had been given serum prepared from Corynebacterium. The temperature had been 39·5° C. The respirations were increased. There was nothing obviously wrong with its bodily condition or appetite. *Post-mortem* examination revealed the presence of a severe pericardial and pleural inflammation with thick, partly organised deposits of connective tissue. Near the root of one lung there was an abscess. The lymph glands were slightly enlarged, but were succulent on section. Pure cultures of Corynebacterium were obtained from lymph glands and the lung, but no pigment was formed in the cultures from the lymph glands. Growth of Corynebacterium mixed with other bacteria was obtained from the fibrinous deposit of the pleura.

(9) 1182/27. Specimens of organs of a one-month-old foal, consisting of lungs, heart and mesenteric lymph glands, were received for examination. The animal had received a prophylactic inoculation of vaccine. Judging from its exterior, it had been in good health and been exhibited for registration but died two days later. The lungs were partly indurated and contained numerous abscesses varying from the size of a hazelnut to that of a walnut and filled with greyish-red pus. The mesenteric lymph glands exhibited abscesses as large as a man's fist. Cultures were made from two lung abscesses: growth of Corynebacterium was obtained mixed with gas-producing rods=coli. No streptococci could be shown.

(10) 1941/28. Lungs of a foal. These showed indurated areas with yellowish-white decomposing necrosis. The walls of the abscesses were smeary like clay, and the abscesses were not sharply marked off from the surrounding indurated areas. Certain areas of the lungs showed a resemblance to liver with respect to consistency and colour. The presence of Corynebacterium and streptococci was ascertained both microscopically and culturally.

(11) 2551/29. The foal was about three months old when it died, after an illness lasting a week. Lungs, liver and kidney, were sent in for examination. Numerous abscesses, lying in greyish-red indurated tissue of a firm hepatic consistency, were found in both lungs. The abscesses presented a motley picture on microscopic examination. Besides Corynebacterium, streptococci were also present in the cultures.

(12) 1975/30. Lungs, liver, spleen, kidney and intestine. The lungs were for the most part indurated with several necroses and abscesses. The other organs showed nothing abnormal. Cultures were made from lung necroses, kidney and spleen. Growth was obtained only from the lung, Corynebacterium in pure culture being obtained. The isolated bacteria were agglutinated with a specific corynebacterial serum obtained from a horse in a dilution of 1:320.

(13) 3520/31. Carcase. A subcutaneous oedema was noted between the fore legs. The heart was severely degenerated and enlarged. No pleurisy was present. In the anterior aspect of the right lung there was a thin-walled abscess about the size of a man's fist. Numerous small irregular foci of consolidation were found in the left lung. Some of these foci showed grey disintegration. One of the bronchial lymph glands was as large as a hen's egg and contained thick pus. Other lymph glands at the root of the lung were also swollen and succulent. The cultures from the abscess in the lymph gland gave a pure growth of Corynebacterium. In the pulmonary abscess there were also present Gram-negative rods and streptococci. Pigment did

Fig. 1.

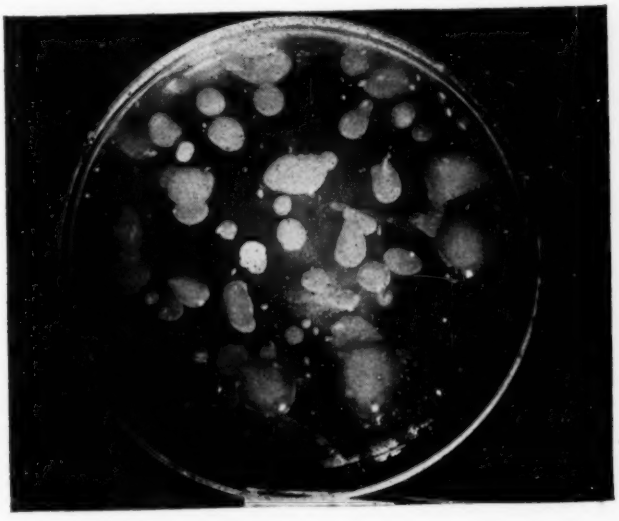

Fig. 2.

Fig. 3.

Fig. 4.

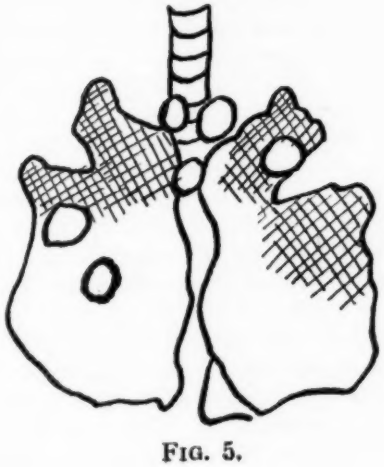

Fig. 5.

Fig. 6.

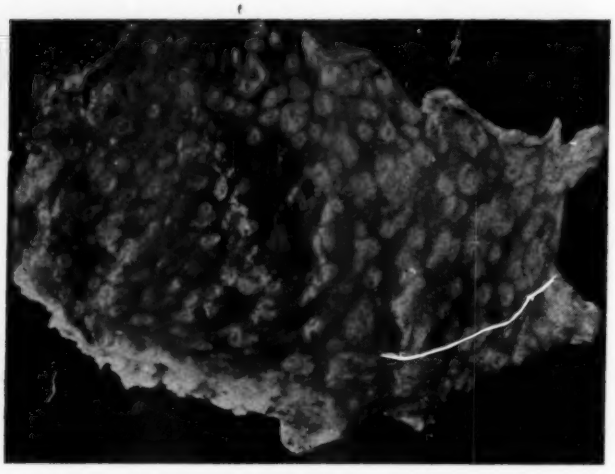

Fig. 7.

Explanation of Figures

Fig. 1.—Abscess formation eight days after subcutaneous inoculation of a horse at three different places in the neck with three different strains of *Corynebacterium equi*, which had been preserved in culture for 10 to 15 years. The virulence remains practically unchanged.

Fig. 2.—Agar-plate with a smear from pus containing *Corynebacterium equi*. After three days very large, moist, glossy, irregular surface colonies, which after some days become pink in colour.

Fig. 3 (988/24).—Portion of small intestine with mesentery. Large abscesses in the mesentery together with an ulcer in the intestine.

Fig. 4 (988/24).—The same portion of intestine as in Fig. 3, which has been cut up after fixation in formalin. The orifices of the ulcers in the intestinal wall are visible.

Fig. 5 (591/25). — Schematic representation of the pulmonary changes in a case of diphtheroid pneumonia.

Fig. 6 (3630/31).—Enlarged lymph glands along the colon and the caecum in diphtheroid pyaemia.

Fig. 7.—Cut up portion of the caecum showing numerous ulcerations with elevated, sharp margins in diphtheroid pyaemia.

not appear in the cultures until after the fifth day.

(14) 3630/31. Carcase of an old foal. No pleurisy or peritonitis was noted. In both left and right lungs there were deep completely indurated areas, which on the cut surface showed a greyish and white softening. The lobus intermedius was transformed into a large abscess. The lymph glands at the root of the lungs varied from the size of a hazelnut to that of a hen's egg. In the cut surface they were greyish in colour and yielded a pus-like juice. In the largest lymph gland there was an abscess containing creamy pus. Greatly enlarged lymph glands were found along the vessels of the colon and the caecum (*see* fig. 6). The lymph glands were juicy and greyish-red in colour. On cutting up the caecum and colon numerous compact ulcers were observed (*see* fig. 7). Both microscopically and in culture *Corynebacterium equi* was shown in pure culture from the lungs and from the intestinal lymph glands. Streptococci were obtained from one of the bronchial lymph glands.

(15) 3780/31. Carcase of an old foal. No fluid was found in the pleural sacs or in the abdominal cavity. Only the right lung showed an abscess, which was thin-walled and contained greyish-red pus. The bronchial lymph glands were enlarged, also the glands in the thoracic duct. These glands were the size of walnuts and contained large amounts of pus. That was also the case with the lymph glands along the whole of the vertebral column in both the thoracic and abdominal cavities. The anterior and posterior roots of the mesentery were surrounded by numerous walnut-sized, suppurative lymph glands. In the mesentery itself there was a fluctuating abscess as large as a man's head. In the mesentery, close to the intestinal wall, there were several abscesses varying in size up to that of a hen's egg. Microscopically and culturally Corynebacterium in pure culture was obtained from the lymph glands of the thoracic duct and of the mesentery. The cultures obtained from the caseous pus in the intestinal abscess were overgrown by coli.

(16) 3848/31. Carcase of an old foal. No fluid was found in the thoracic cavity. In the right lung there was an abscess, the size of a hen's egg, which was situated just below the pleura. Abscesses as large as walnuts, which did not reach the surface, were also found in several places. In the left lung extensive areas of induration were observed, with here and there hepatisation with liquefying foci. The bronchial lymph glands were as large as hens' eggs and on section showed a greyish-red colour and small abscesses here and there. Cultures were made from bronchial lymph glands, pulmonary abscess and spleen. No growth was obtained from the spleen. Pure cultures of Corynebacterium were obtained from the other foci. The cultivated strain was agglutinated with a specific horse serum. Agglutination was produced in a dilution of 1:640. Normal horse serum did not cause agglutination.

(17) 851/32. Carcase of a foal sent in by a farmer in the vicinity of Malmö, which is the only case I have seen that did not originate from the stud mentioned. The animal was about two months old and had had respiratory trouble for about two weeks. Large portions of the lungs showed red hepatisation, with here and there round, hazelnut-sized abscesses. The lymph glands at the root of the lungs were somewhat enlarged and succulent. Otherwise nothing abnormal was noted. Pure cultures of Corynebacterium were obtained from the lymph glands. Besides Corynebacteria, Gram-positive diplococci grew in the cultures from the lung.

Morbid Changes

The pyaemia in foals under discussion when due to pure Corynebacterial infection is easily differentiated from ordinary joint-ill by the patho-anatomical changes. In the great majority of cases the disease manifests itself as a suppurative bronchopneumonia with greyish-red pus in the bronchi and an *intense purulent infiltration of the pulmonary lymph glands*. In my material, which comprised 24 cases, there was only one in which the lungs were found to be intact. In this case it was a question of a purulent process in the mesenteric lymph glands and in one of the testicles, and pleuritis. In addition to the lungs, the corresponding lymph glands were always affected and most frequently changed by abscesses. In a few cases the disease was localised also to the lymph glands of the thoracic duct and of the mesentery. In two cases, 988/24 and 3630/31, ulcers occurred in the intestine in association with very large abscesses in the corresponding part of the mesentery. It is noteworthy that in no case did I find any purulent processes in the tendon sheaths or the joints, except in those cases where joint-ill was present at the same time (see my first publication). Another noteworthy feature is that in spite of the extensive changes in the lungs pleuritis did not as a rule develop. In one case there was an old organised pleurisy and in another case pleurisy was found without any involvement of the lungs. An unusual localisation was the eyes (case 988/24). This was the case of a three-month-old foal, in which numerous abscesses were found in the lungs, large abscesses in the mesenteric lymph glands and necrotic processes in the intestinal mucosa. I have never seen a case in which the liver, spleen and kidneys were affected. It is also worthy of note that the cervical organs were always intact. Neither the submaxillary nor the retropharyngeal lymph glands showed any lesions, an important point in differentiating this disease from strangles. I have also made a comparison between the pulmonary changes in ordinary infectious pneumonia and those found in pneumonia caused by *Corynebacterium equi*. In the former the indurations are as a rule localised to the anterior and lower parts of the lungs. Pleuritis need not occur. It is a more diffuse, uniform, lobar pneumonia, which seldom gives rise to the formation of abscesses. The lymph glands become somewhat enlarged, juicy and red in colour but they are not so intensely affected as in Corynebacterial infection and they do not form abscesses.

The Incidence of the Disease

As far as I am aware the disease has occurred in only two localities in Sweden. Nearly all the cases have appeared in a stud of "warm-blood" horses, where 18 to 24 foals are born annually. Only one case has occurred in another stable, which has no connection with the stud mentioned. The following numbers of deaths have been brought to my notice: 1917 one, 1919 two, 1922 nine, 1923 two, 1924 ten, 1925 three, 1926 two, 1927 two, 1928 one, 1929 one, 1930 four, and 1931 four. No case has occurred since 1931. Thus the total number of cases which have occurred at the same stud during the period 1917-1931 amounts to not less than 41. In other countries it also appears as if the disease occurs especially where there is a large number of foals. Thus Bull reports from Australia the occurrence of four cases in a stud where 45 mares had dropped foals during the season. Schmiedhoffer mentions that at the Kisbér stud in Hungary they had 16 cases of the disease among 77 foals, five of which died, and at Babolna 69 cases with 11 deaths among 112 foals. Cech has privately informed me that he has had numerous fatal cases of disease caused by *Corynebacterium equi*, at the Military Stud at Hostouni in Czechoslovakia. According to a report by Ferd. Golasewski, a similar disease had also occurred at the Hostau State Stud at Radautz in Roumania. Miessner and Wetzel mention three cases from a stable of 45 mares. Witte had three cases from the same stable. Lütje mentions a stud in which five cases of disease had occurred, which was believed to have been strangles, but the pulmonary abscesses did not contain any strangles streptococci. He believes that he saw numerous cases of the same kind in a Russian foal depot during the War.

Otherwise, judging from the reports of the Association of Specialist Veterinary Surgeons for Combating Breeding Diseases (Fachtierärzte für die Bekämpfung der Aufzuchtkrankheiten), the disease does not appear to be very common. At the meeting held in May, 1937, eleven cases were reported, being 2·3 per cent. of the material sent in = 483 cases. Six of these eleven cases were investigated at the Veterinary College at Hanover. At the 1936 meeting only two cases were reported.

I have never observed the infection in adult horses. Minett, who investigated the occurrence of diphtheria-like bacteria in the horse, does not seem to have met with *Corynebacterium equi*. The only case in which the diphtheroid bacillus in question was isolated from an adult horse is the one described by Carne. This was the case of an eight-year-old trotting mare, which died after a short illness. The *post-mortem* examination revealed a morbidly changed kidney and some small foci in the lungs. The description given is, however, incomplete.

Pathogenicity

It is strange that the diphtheroid bacillus in question has not yet been discovered as a spon-

taneous pus-producer in any other animal than the horse. According to BULL, guinea-pigs exhibit a certain susceptibility to intraperitoneal inoculation. In repeating these experiments I also found that guinea-pigs develop a purulent peritonitis, which is, however, not always fatal. In my previous experiments, on the other hand, I obtained a small abscess in a *goat* after a subcutaneous inoculation. A *pig*, after receiving a subcutaneous injection into the thigh, exhibited a month later a walnut-sized abscess at the site of injection along with liquefaction in the neighbouring lymph glands. One experiment on foals has been successful, a typical suppurative pneumonia being obtained. An emulsion of a small (Löffler) culture was injected into the trachea. Nine days later the animal had fever and a typical broncho-pneumonia, the temperature rising to 41·3° C. After a week's illness, the foal died exhibiting the same picture as that seen in the spontaneous cases. The lymph glands were much enlarged and on section showed purulent secretion.

Agglutination Experiments

When it had become evident that agglutinins were never formed in the infected foals, although the disease frequently lasted for months, and that they were not produced in foals which had survived the infection, attempts were made to produce agglutinating sera by means of a protracted treatment of two horses. As a matter of fact this experiment was carried out in order to try to obtain an immune serum for therapeutic purposes. One of the horses was first given subcutaneous injections of living cultures, followed by intravenous injections of killed cultures every tenth day. After nine such injections the titre rose to 1 : 40, but could not be raised any higher. After the ninth injection, the other horse received killed cultures (after the fifth injection the titre was 1 : 80) and was then given four injections of living cultures up to a dose of 125 c.c. of broth culture. The titre increased to 640, but did not reach as high as 1,280. The horse did not, however, tolerate the last two injections so well, developing a severe lymphangitis in all four legs with exudation of lymph, especially from the skin of one of the fore legs. Some ten different strains, which had not been used in the treatment, were all agglutinated equally easily. The same titre was also obtained with a strain received from BULL in Australia. Broth cultures and emulsified Löffler cultures, not killed, were found to be the best antigens. Thus it was possible by means of repeated intravenous injections into horses to produce agglutinins.

Treatment

Various kinds of chemotherapy have been tested but all of them proved to be ineffective. When half of all foals dropped in 1922 succumbed to the disease, experiments were made the following year, 1923, with preventive inoculation subcutaneously of a vaccine consisting of 10 c.c. killed broth cultures. One foal died in spite of the treatment. Another foal, which had not been vaccinated, also died. The other 16 foals did not develop the disease. Thus the result seemed to be good. But in the following year, 1924, ten out of 22 foals died in spite of the vaccination. No certain effect could therefore be expected by this method. In 1927 and 1928 a specific serum was produced. This was tested on two foals which had been infected. Both animals recovered. Since then no further tests have been made with the serum owing to the fact that the disease became less frequent.

It appears in general that foals born early in the year are less frequently infected than those born in the spring or in the summer. The average time of foaling at the stud was formerly May 1st, but it was gradually forced back so that lately the average foaling time is about March 15th. Together with this change the number of cases of infection has also gradually decreased.

There is every reason to believe that the causal agent was present in the soil. The organism is a very resistant diphtheroid bacillus, which can multiply at ordinary summer temperature and is not very particular as to the culture media. Further, it does not spread to other studs or stables, although mares and stallions have frequently been sold or removed from the stud in question. It was therefore improbable that the infection was transmitted by carriers. On that account all foalings were carried out, as soon as possible, at an outlying farm, and since seven years past the disease has disappeared entirely.

Conclusions

The present work is a continuation of the investigations, published in 1923, into the occurrence of a suppurative pneumonia in foals caused by a specific infection. The causal organism is a diphtheroid bacillus, most closely related to Hoffmann's bacillus, but differing from it in being chromogenic and pathogenic for horses, swine and guinea-pigs.

It is pointed out that the organism was incorrectly called *Corynebacterium pyogenes* by MIESSNER and WETZEL, which led to its being confused in the literature with *Bacterium pyogenes* (GRIPS, KÜNNEMANN, GLAGE and NIEBERLE), a bacillus which is never found as a pus-producer in the horse.

It is probable that the disease is commoner than it is supposed to be, because it has certainly been confused occasionally with strangles and with streptococcal and diplococcal pneumonia.

The new material investigated consisted of

parts of organs or carcasses of a further 17 foals' and in certain cases pyaemia was also found in other organs than the lungs, but never in liver, kidneys, spleen, the joints or the cervical lymph glands.

Corresponding lymph glands are always affected and frequently proceed to liquefaction. Cases also occur with intestinal ulcers and large abscesses in the mesenteric lymph glands.

The disease occurred almost exclusively in the same stud of "warm-blood" mares, where it was prevalent from 1917 till 1931. As a result of measures whereby all foals were dropped at another farm the disease has disappeared altogether since 1931.

In cultures *Corynebacterium equi* forms a light rose-coloured pigment, which may become salmon-coloured and in extreme cases the colour of red brick.

Experimentally it can produce suppurative pneumonia after intratracheal injection into foals, and subcutaneous abscesses when injected by the subcutaneous route.

Subcutaneous abscesses were obtained in pigs, and in certain cases also abscesses in the neighbouring lymph glands. Subcutaneous abscesses were also obtained in goats. Purulent peritonitis is produced in guinea-pigs, which is, however, not fatal.

No agglutinins are met with in the affected animals, but they can be produced in the horse by repeated intravenous injections of large doses.

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After the above paper had been written, Prof. H. C. Bendixen and Prof. Aage Jepsen, of the Veterinary College, Copenhagen, in an investigation into the occurrence of suspected tuberculosis in the swine herds of two large farms and also in the examination of extensive material of suspected swine tuberculosis from a number of slaughter-houses, called attention to the interesting circumstance that, in seeding homogenised material on Löwenstein and Besredka's medium, they obtained in twelve cases growth of the same bacillus as that described by me above as *Corynebacterium equi*. In all probability it is the same organism as that already described in so-called tuberculosis of the cervical lymph glands in swine by Holth and Amundsen in Norway in 1936 and by Plum and later by Jespersen in Denmark in 1938.

Holth and Amundsen describe the organism as a coccobacillus and consider it to be relatively acid-fast. Plum found Holth and Amundsen's bacillus in 15 out of 128 pigs examined from the same slaughter-house. In cultivations on Löwenstein's medium, when the cultures were allowed to stand for two and a half to three months, Jespersen, working at the slaughter-house in Odense, Denmark, obtained only tubercle bacilli in 50 cases out of 96, coccobacilli mixed with tubercle bacilli in two cases and coccobacilli alone in 24 cases. In the remaining 20 cases no growth was obtained. In experiments on swine, Bendixen and Jepsen showed that feeding the animals with cultures regularly *produced infections which were localised to the air-passages in the form of a subacute or chronic pneumonia. Subcutaneous injections produced, in the same manner as Corynebacterium equi, abscesses with metastasis to the regional lymph glands in both horses and pigs. These authors also let it appear that in swine the infection is not of such a harmless nature that it only localises itself to the cervical lymph glands, giving rise there to tuberculosis-like foci, but that it may also play a role as the cause of disorders of the respiratory tract.*

I have myself established the presence of the same type of infection of the cervical lymph glands of swine as that shown in both Norway and Denmark. So far 146 pigs from different parts of the country have been examined. Inoculation and cultural experiments have shown the presence of tubercle bacilli in 85 cases, Holth and Amundsen's bacillus in 22 cases and absence of bacteria in 39 cases. After my attention had been called by Bendixen and Jepsen to the close resemblance to *Corynebacterium equi*, I immediately carried out comparative experiments on horses and swine and also performed a number of cultural experiments. The cultures were of exactly the same salmon colour with polymorphic Corynebacteria, which grew rapidly on any artificial medium. The bacteria were highly resistant, which is shown by the fact that they tolerate the same treatment with acid as tubercle bacilli in making cultures by Löwenstein's technique.

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SHORTHORN SOCIETY'S TESTING REQUIREMENTS FOR ANIMALS AT SHOWS AND SALES

At a recent Council Meeting of the Shorthorn Society of the United Kingdom of Great Britain and Ireland, it was decided to require that in future all tuberculin tests of animals consigned to the Society's shows and sales at Birmingham and Reading should be made by means of the Royal Veterinary College (Camden Town) synthetic tuberculin. The first sale to which this new regulation applies is the spring show and sale to be held at Reading on March 29th next.

We are informed that the Society will also require all animals consigned to these shows and sales to have passed the agglutination blood test, and this regulation will apply first to the show and sale at Reading on March 29th next.

General Conditions Governing the Origin and Development of Infectious Diseases*

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"Infection," for the purpose of this address, may be defined as the entrance of micro-organisms into the body and their multiplication therein. And an "infectious disease" may be regarded as a condition in which the infective micro-organism can be transmitted from one individual to another thereby causing the same disease in the second individual as existed in the first. An important feature of an infectious disease is its tendency to spread amongst susceptible individuals, essentially in the same way as a fire will spread in combustible material if a spark is introduced.

In the present state of our knowledge we think of these micro-organisms as belonging to three categories: bacteria, protozoa, and viruses. In some instances, however, macro-organisms (*i.e.*, mites, worms, etc.) may also cause conditions which behave exactly like true infectious diseases; but in the main our remarks will be confined to diseases caused by the three types of organisms first named.

Losses due to infectious diseases have probably been sustained by man ever since he first acquired and bred domestic animals. Indeed, the ravages caused by infectious diseases in bygone centuries were probably proportionately much heavier than they are now, if we take into consideration the much smaller animal population at that time. Therefore, when we read, for instance, that the losses from rinderpest in Europe up to the end of the eighteenth century amounted to 200 million cattle; or that Holland, during the decade 1830 to 1840, lost about 600,000 cattle from pleuropneumonia; or that in one year (1892) Germany suffered a loss of 100 million marks on account of foot and mouth disease; or that in Hungary two million pigs contracted swine fever in the years 1895 to 1898; or that Southern Africa (south of the Zambesi River) lost over five million cattle from rinderpest during the two years 1896 and 1897; we realise what a profound influence infectious diseases have had on the development of animal husbandry. The losses due to some of the diseases just mentioned have certainly been reduced greatly in recent years; but we still

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hear that not very long ago the United States lost on an average about 200 million dollars annually on account of animal diseases, chiefly infectious diseases.

In view of the enormous economic importance of infectious diseases in animals it behoves us to study carefully the conditions which govern their origin and development.

Origin of Infectious Diseases

An infectious disease will appear in a country or area only when and if the infective agent (the "spark" to which reference has been made) is introduced into susceptible animals. Very commonly this occurs through the introduction of an infected animal (perhaps in the incubative stage of the disease) into a clean herd. Most countries take elaborate precautions to prevent such introductions, by means of systems of quarantine and by inspections on their borders or at suitable centres within the country. But modern methods of transport, particularly by air, have increased this danger enormously. The introduction of rabies into England in 1918 by means of a dog which was smuggled in from France in an aeroplane, illustrates the danger to which countries, even isolated countries, are exposed to an ever increasing degree. In this instance it took the authorities several years of hard work to free the country again of this dreaded disease.

But it is not always necessary that an infected animal be introduced. The infected material may be carried mechanically in the hair or wool of healthy animals (*e.g.*, the virus of sheep-pox) or in the hide (*e.g.*, anthrax spores); or it may be carried by man on his hands or clothing (*e.g.*, the virus of foot-and-mouth disease); or it may be conveyed in the carcase or the meat or fat of infected animals (*e.g.*, the virus of swine fever); or again, the infection may be transported by "carriers," *i.e.*, animals which have recovered from the disease but which still harbour the infection which they are capable of transmitting to other animals (*e.g.*, pleuropneumonia). Such carriers are very common in many protozoal diseases (piroplasmosis, trypanosomiasis, etc.). These animals appear perfectly healthy but carry the infection in a latent form (state of premunition) and may be responsible for a fresh outbreak of the disease.

"Carriers" may also consist of a species of animal which normally does not show clinical signs of the disease, but may yet convey the infection to the susceptible species. Examples of this type of infection are not uncommon—the best known is probably that of game carrying nagana—but two further cases may be mentioned here because of their special interest.

In the Northern Transvaal it was found that two species of wild pig, the bush pig (*Kairopoamus choeropotamus*) and the wart hog (*Phacochoerus aetiopicus*) were carriers of swine fever, although they never show any symptoms of the disease. However, when they come in close contact with domestic pigs, as sometimes happens on the more remote farms, they may be responsible for a fatal outbreak of the disease. The second example concerns a disease called "snotsiekte" in South Africa (a form of malignant catarrhal fever). In this case two species of antelope, the black wildebeest (*Connochaetes gnu*) and the blue wildebeest (*Connochaetes taurinus*) act as carriers of the infection. When they come in close contact with domestic cattle a serious outbreak of "snotsiekte" may result.

The spark of infection may also be introduced in other ways. In the case of diseases transmitted by an intermediate host it is sufficient that an infected specimen of this vector be brought into contact with susceptible animals. Thus an infected tick may be carried a long distance, *e.g.*, in hay, and then find its way on to a susceptible beast. There is no doubt that in South Africa, East Coast fever has been carried in this way more than once, and some obscure outbreaks of this disease must probably be attributed to a native conveying an infected tick in his blankets. Similarly, infected tsetse flies may be conveyed in motor cars or by other means and then set up an infection in a previously clean area.

Do New Infectious Diseases Arise?

Laymen frequently ask the questions, "Where did this disease originate?", "When did it first appear?", "Are any new diseases likely to arise which might exterminate our animals or mankind itself?" Such questions should perhaps be addressed to philosophers and theologians rather than to men of science. And yet we are not entirely at a loss for an answer. We may not actually have observed new diseases appearing as if by a process of spontaneous generation, but we can certainly see before our eyes new diseases being produced by a process of differentiation from a common stock. How else are we to interpret the existence of different strains of bacteria or viruses than through differentiation of a single species into separate strains? When the process has gone far enough we speak of different diseases; before it has gone so far we speak of varieties of the same disease. Examples could be quoted by the score; a few only will be mentioned here. (1) Three immunologically different strains of *foot-and-mouth disease* have been recognised for some years. However, recent work would indicate that the antigenic structure of the three strains is not so different as was at one time thought. It would almost appear as if the process of strain-making is still going on actively. (2) In *horsesickness* a somewhat larger number of strains has been identified; apparently the process of differentiation has

gone somewhat further in horsesickness than in foot-and-mouth disease. (3) In the United States of America two strains of *equine encephalomyelitis*, the Eastern and the Western, have been studied. The strains differ, not only immunologically but also in their effect on the animal (clinical picture) and in the method by which they are transmitted. Again, this disease bears a close resemblance to *Borna disease*, but is regarded by most authors as being sufficiently distinct to warrant a separate name. Thus we see here a process of splitting which apparently, in the case of Borna disease and encephalomyelitis, has gone far enough to have produced two distinct diseases, but in the case of the two strains of encephalomyelitis in America has not gone so far.

We may continue this line of reasoning and point to the group of *pock diseases* where, according to most authorities, we have arrived at a stage where we can speak of six or eight different diseases: smallpox, cow-pox, sheep-pox, goat-pox, horse-pox, swine-pox, camel-pox, rabbit-pox. One member of the group, namely ecthyma contagiosum (" vuilbek," " sore-mouth ") has become separated a bit further than the rest, and is generally regarded as a separate disease. Some of the members of the pock group are so closely allied that many authors regard them as strains of the same disease, but consider the others as separate diseases. Obviously the process of differentiation has gone a stage further in this group than in the encephalomyelitis group, although there can be little doubt that these pock diseases too originated from a common ancestral stock.

Further differentiation still may be considered to have taken place in other groups of similar diseases. The *influenza* group furnishes a good example. Influenza catarrhalis, influenza pectoralis, and infectious cough (Hoppegarten disease) of horses, infectious bronchitis of cattle, swine influenza and human influenza all have features in common, but have become separated so far that no one doubts their independent identity.

Many more examples could be quoted, but enough has been said to indicate the lines along which differentiation may proceed. Given a single disease we may picture to ourselves a process in which, first of all, the variability inherent in all living matter will lead to the appearance of separate strains; these may then, probably by adaptation to different climatic conditions and to different modes of transmission, become differentiated into entirely separate diseases. It is not difficult to conceive that a group of diseases including, say, foot-and-mouth disease, vesicular stomatitis, vesicular exanthema, rinderpest, malignant catarrh of cattle, " blue-tongue " of sheep, and perhaps others, all of them diseases with a peculiar affinity for the mucous membranes, but differing in many important features, by such a process of differentiation, have originated from a common parent stock.

Or again, the group of " *neurotropic* " *virus diseases*, such as rabies, pseudorabies, Borna disease, encephalomyelitis, louping ill, etc., may have had a common origin. It seems probable that the diversity in this group was brought about by adaptation to entirely different modes of transmission (by direct bite in the case of rabies; mosquitoes in the case of encephalomyelitis; ticks in the case of louping ill, etc.).

There are yet other ways in which apparently " new " infectious diseases may arise. Mention has already been made of diseases like swine fever and " snotsiekte " which may be present in wild animals in an " inapparent " form, but which may flare up when these latent carriers come in contact with susceptible animals. In these cases a new infection may appear to arise from nowhere, unless the rôle played by the wild animals is known.

But more instructive still is the position in regard to *trypanosomiasis*. We may assume that in the course of time a perfectly harmonious relationship developed between trypanosomes, tsetse flies, and game. It is doubtful whether the trypanosomes at any stage caused " disease " in the game. And the tsetse flies acted as innocent carriers of the trypanosome from antelope to antelope. But then at some stage man with his domestic animals appeared upon this peaceful scene. The tsetse flies now found a new food supply near at hand and conveyed the trypanosome infection to these animals. but no such harmonious relationship existed between trypanosome and domestic animal, as had developed by a gradual process of evolution between trypanosome and game, and the result was a fatal disease. This is no fanciful picture. The same process may be repeated at any time by taking cattle or other domestic stock into a tsetse fly belt where the game harbour trypanosomes.

The question may be asked, do we know of new diseases which have appeared in recent years? And the answer seems to be in the affirmative. Even if we take into account the possibility that the appearance of supposedly new diseases may be due simply to more accurate diagnosis and improved methods of investigation, we still have a number of diseases which definitely seem to have appeared for the first time, at any rate in civilised countries, in very recent years. Two examples may be quoted. *Swine influenza* was first observed in the Middle West of the United States of America in 1918. Since then the disease has spread to many countries. It is such a distinctive and easily recognisable disease that it must of necessity have been recognised before, had it existed. Meanwhile we know nothing about its origin. The second example is *canine hysteria*.

This disease first made its appearance in the Southern States of the United States of America, about 1916. It reached Canada about 1920 and first appeared in England about 1924. To-day it is recognised as a definite disease in many parts of the world. Again its origin is completely obscure.

The Spread of Infectious Diseases

The rapidity with which a disease will spread depends very largely on its mode of transmission. Probably the slowest form of propagation is encountered in diseases such as tetanus or quarter evil where the infecting organisms are found *in the soil*. A somewhat similar condition exists in the case of "lamsiekte," a form of parabotulism of cattle in South Africa and other countries. Here the bacteria are also present in the soil and in this way may enter bones or other carcase material in which they produce toxins; when this material is eaten by an animal the disease is produced.

In diseases which are *transmitted by contact* the spread of infection is much more rapid. Before the days of fast mechanical transport the rate of spread was determined by the movement of the animals themselves. The great epizootic diseases periodically swept across Europe from east to west, and it usually took a few years before the infection reached the western countries. An interesting example of this mode of spread is furnished by the invasion of Africa by rinderpest at the end of last century. According to Lugard the disease crossed the Red Sea from Arabia into Africa in 1889. It then travelled southward along the Nile with the Italian armies in 1890 and continued its southward course through Africa. Uganda was reached before the end of the year, and Nyasaland about July, 1892. In February, 1896, it was reported on the banks of the Zambesi River and in March Bulawayo was reached. The disease appeared at Mafeking in April, 1896, and at Kimberley in October. It was checked for a time on the Orange River by a fence, but in March, 1897, it appeared south of the line and before long it had spread practically to the southernmost point of the continent. It was stated at the time that the disease travelled at the same rate as an ox waggon.

With *modern means of transport* long distances can be bridged in a short time. In this way infectious diseases have been carried to distant countries and frequently great losses have been inflicted. As a classical example may be mentioned the introduction of surra into the island of Mauritius in 1901 by means of cattle from India. The disease spread rapidly on the island and killed off a large percentage of the animal population. The same disease was introduced into South Africa with camels from India in 1904; into the United States with zebus in 1906, and into Australia with camels in 1907. In all these cases the disease was eradicated by slaughtering the infected animals. Similarly rinderpest was introduced into Belgium in 1920 by zebus from India. And in 1923 this disease also broke out in Western Australia having been brought there with animals from Singapore. But both outbreaks were very soon suppressed.

The spread of infectious diseases is favoured not only by transportation over long distances but also by the *movement of animals within a country*. Markets and sales are fruitful sources of infection. Here animals are brought together, perhaps from long distances, and contact is established with a large number of animals which may again be distributed over a wide area. Also the activities of traders who go about buying animals on the farms and move from farm to farm, must be looked upon with suspicion. Swine fever has frequently been spread in this way.

But even genuine farmers, who sometimes have to move their animals over long distances, may be responsible for the spread of diseases. In South Africa scab in sheep would probably have been eradicated long ago but for the extensive movements of sheep especially in times of drought. And most outbreaks of East Coast fever must be attributed to a similar cause.

Any event which may lead to large-scale movements of animals across a country or across a continent may cause infectious diseases to spread. In this category of events *wars* take the first place. Indeed many of our most important epizootics may be termed *war diseases*. Thus the history of rinderpest in Europe during the last few centuries is virtually a recapitulation of the history of the wars of that period. Even in modern times this disease has followed in the wake of wars. Bulgaria became infected during the Balkan war in 1913, and during the Great War of 1914-1918 the disease spread rapidly in Russia and invaded Roumania, Bulgaria, Poland and Greece.

Many other diseases accompany wars: glanders, epizootic lymphangitis, ulcerative lymphangitis and mange in horses were all prevalent during the last war, but practically disappeared soon after. Infectious anaemia spread to an alarming extent all over Europe and to countries outside Europe. Even pleuropneumonia appeared in countries (*e.g.*, Germany) from which it had been absent for many years. That a highly contagious disease like foot-and-mouth disease should spread rapidly during war time is not surprising in view of the reduced efficiency of the State veterinary service under such conditions.

The Spread of Non-contagious Diseases

Equally interesting is the study of the spread

of diseases other than contagious diseases. Of special interest are those transmitted by *arthropod vectors*. If the transmission is effected by winged insects it is not surprising that the disease should spread rapidly over a wide area; but when the transmitter is a tick with its very limited powers of locomotion, the opposite would be expected. And yet we find that a disease like redwater of cattle (Texas fever) or East Coast fever can spread just as rapidly and far more insidiously than most directly contagious diseases. The history of the original introduction of East Coast fever into and its spread over southern Africa is interesting and instructive. The infection was brought in 1901 with a consignment of cattle from Tanganyika to Beira in Portuguese East Africa. From Beira the cattle were sent to Umtali and Salisbury in Southern Rhodesia, where they were grazed on the townlands and where mortality occurred amongst them before they were slaughtered. In the light of subsequent experience we know that infected ticks must have dropped on the pastures where these cattle grazed. Later in the year 1901 one thousand head of cattle were sent from Australia to Rhodesia. These cattle were also landed at Beira and grazed there before they were sent to Umtali. At both centres heavy mortality occurred until practically the whole herd had died. Still the authorities did not suspect a new disease but ascribed the mortality to redwater. It was only when Rhodesian cattle also began to die in great numbers at these centres and when the disease began to spread to other areas that it was realised that a new disease had invaded the country. Soon almost the whole of Southern Rhodesia was infected and in 1902 the disease spread into the Transvaal. During the next two years a great part of Natal and the adjoining territories also became infected. Here then we have a disease transmitted by a tick which can only convey the infection by the slow process of dropping off the infecting animal, moulting on the ground after the lapse of several weeks, then crawling on to a susceptible animal and engorging itself with blood over a period of several days. And yet we find that the disease can spread over a large section of a continent in a few years. Moreover, the infection may persist, thanks to the longevity of the ticks, for a long period in an area where once it has established itself.

Enough has been said to indicate the diversity of methods which operate in the spread of infectious diseases.

Factors Influencing the Spread of Infectious Diseases

The factors which have an influence on the spread of an infectious disease may be grouped into three categories: (1) factors connected with the animals themselves, their susceptibility, etc., (2) factors connected with the virus itself, its pathogenicity, etc., and (3) factors connected with external conditions such as climate, nutrition, etc.

The first group of factors will be dealt with by Professor Frei and needs no further reference here. For convenience the third group of factors will be discussed first.

That the *soil* has an important bearing on the origin and development of infectious diseases, has long been known. Mention has already been made of diseases like tetanus, quarter-evil or "lamsiekte" (parabotulism), the causative organisms of which may be found in the soil. The last-named disease has features of peculiar interest. Long before the aetiology of this disease was understood it was realised that there was some connection with the soil. Sir Arnold Theiler was so convinced of this relationship that, at one stage of the investigation, he had a hundred tons of soil transported from a "lamsiekte" area to a clean area, to see if he could reproduce the disease in this way. Later on Theiler found that the ultimate cause of lamsiekte was the phosphorus deficiency of the soil, which was responsible for the phosphorus deficiency of the pasture and hence also for the phosphorus deficiency of the cattle grazing on such pasture. In order to satisfy their craving for phosphorus these animals then chewed bones or other animal debris and in this way ingested the toxin which produced the disease. Thus the soil plays a double rôle in the causation of lamsiekte, firstly through its mineral deficiency and secondly through the bacteria which grow in the carcase material.

The soil may also be an important factor in the spread of worm infections. Mönnig has shown that *Gaigeria* (the hookworm of sheep) will only thrive on sandy soil.

Rainfall is another very important factor in the spread of infectious diseases. Many diseases are propagated only under humid conditions. Frequently this is due to the fact that the vector of the disease needs moisture for its multiplication and other activities. Thus we find that both horsesickness and bluetongue (catarrhal fever) of sheep in South Africa are entirely dependent on the rainfall for their spread. If heavy rains fall early in the season, both diseases will be very prevalent; on the other hand, when there is a dry season, the diseases are almost absent. These diseases usually start about two or three weeks after the first rains. This is the period in which the vectors presumably hatch and infect the animals.

But rainfall may have a pronounced influence even on diseases which are directly transmitted. Thus it has been shown that fowl cholera has a very much higher pathogenicity in a humid than in a dry atmosphere.

The *vegetation* which is in a sense the product of soil and rainfall may also have a direct bearing on the distribution of some diseases. This applies particularly to the trypanosome diseases whose vectors, the tsetse flies, depend to a great measure on the type of vegetation. Some species can exist only in dense tropical forest, others in park land, and yet others in the drier open country. Naturally the spread of the trypanosomes carried by these species will be determined by these factors.

Temperature is another factor to be considered. When we speak of tropical diseases we think in the first place of diseases which will thrive in a hot climate. But it is unlikely that the temperature alone determines the distribution of a disease. Usually it is a combination of all the factors which constitute "climate." In heartwater, for example, we find that the vectors, ticks of the genus *Amblyomma*, occur only in warm and moist places and this has been the determining factor in the spread of this disease.

However, there may be conditions when temperature alone plays an important part in the development of a disease. Thus Nuttall and others showed that ticks infected with East Coast fever, when kept at a low temperature (10° C.) for three weeks, are incapable of transmitting the disease, but regain their infectivity when warmed to 30° C. for two days. A sufficiently high temperature is therefore quite essential for the spread of East Coast fever.

But if hot weather favours the development of certain diseases, direct *sunshine* may be inimical to others. We know that most viruses are destroyed fairly easily when exposed to the sun, and even the majority of bacteria cannot withstand the action of direct sunlight for long. This may explain the relative mildness of diseases like foot-and-mouth disease and their tendency to die out spontaneously in tropical countries. And yet, in other cases, diseases which are usually associated with cold, damp, and foggy countries, may flourish in warm and sunny climates. An interesting example was revealed some years ago when a severe outbreak of tuberculosis was discovered in a number of Kudu (*Strepsiceros strepsiceros*) in the Albany district of the Cape Province in South Africa. These animals are completely wild and run in an area which has a low rainfall and a maximum amount of sunshine; but in spite of this the disease spread readily amongst them. Sunshine cannot therefore be regarded as an absolute safeguard against infection.

Apart from these climatic factors there are other conditions which are of importance in the spread of a disease. One such factor is *nutrition*. Generally speaking animals in good condition have more resistance to disease than those in poor condition. In countries like South Africa where severe droughts are of fairly frequent occurrence, infectious diseases take a heavy toll of the half-starved animals during such periods. This is specially true of worm infections which may spread to an alarming extent and cause very severe losses during a period of drought.

The individual factors responsible for this increased susceptibility need not be discussed here. A deficiency of Vitamin A is generally regarded as predisposing towards infection. But in most cases it is general lack of food, a condition of semi-starvation, which leads to a spread of disease.

With regard to certain diseases the opposite view has also been held. Edwards has shown that rats on a good diet are much more susceptible to foot-and-mouth disease than those on a deficient diet. Whether the same applies to cattle is still doubtful. In this connection it should be borne in mind that the conditions necessary for the spread of an acute virus disease need not be the same as those which favour the development of a chronic bacterial infection. Thus the view is quite acceptable that tuberculosis (in human beings) spreads easily in undernourished individuals whereas epidemic influenza seems to favour strong well-fed persons.

Another "external" factor which has an important bearing on the spread of infectious diseases is the *density and distribution of the animal population*. Obviously a disease will spread more readily if the animals are crowded together than if they are distributed in small groups over a wide area. The prevalence of swine diseases in countries like the United States, Germany, Austria, etc., is probably in large measure due to the intensity of pig farming and the density of the pig population; whereas in countries like South Africa where the pig industry is not far advanced and where pigs are usually kept in relatively small numbers on widely separated farms, most pig diseases are comparatively rare and some (*e.g.*, swine erysipelas) completely absent.

But this factor may also operate in the opposite direction. In countries where a particular animal industry is well advanced it generally also means that the animals are kept under proper control and that effective isolation can be carried out. On the other hand, in less "civilised" and developed countries there may be fewer animals but these probably roam about on large unfenced farms and proper isolation or quarantine becomes a very difficult matter. An excellent example is supplied by dourine of horses. This disease spread all over Europe during last century, but with the advance in the horse-breeding industry and the improvement in State veterinary control, it was completely eradicated from practically all European countries by the beginning of this century. Then during the Great War the disease was introduced

again, but within a comparatively short time it was eradicated once more. In contrast with this successful campaign in Europe may be quoted the experience in South Africa where the disease has spread to the sparsely populated areas in and around Griqualand West where veterinary control is exceedingly difficult. From this area the disease was transported to the more closely settled districts at the southernmost point of South Africa, but within a few years it was eradicated from this area; whereas the progress made in the northern area is very slow indeed. The brilliant success which Watson and his co-workers had in the eradication of dourine from Canada is all the more meritorious when the wild state of the infected country is taken into consideration.

Another factor to be considered is the *nature and distribution of the reservoir*. Certain phases of this problem have already been discussed; however, mention should still be made of the peculiar conditions which determine the spread of *rabies*. In most countries where this disease occurs, the infection is carried from dog to dog. An infected dog may bite other dogs as well as other animals or human beings, and so the disease may spread over the length and breadth of the country. But in some countries there are interesting departures from this "standard" mode of transmission. Thus in South and Central America it was found that vampire bats (*Desmodus rotundus* and perhaps other species) are carriers of rabies. Until this extraordinary fact had been established, the origin and development of the disease had presented some very obscure features, and for a long time the diagnosis was in doubt. A different type of transmission is encountered in South Africa. Here small carnivores form the natural reservoirs and transmitters of the disease. The chief culprit is the yellow mungoose (*Cynictis penicillata*), but other members of the families *Viverridae*, *Felidae*, and *Sciuridae* may also act as carriers. Why in these countries these animals, and not dogs, should be the carriers of rabies, we do not know. Dogs do get infected in South Africa and die, but they do not seem to propagate the disease. The fact remains that the spread of rabies in these countries is very different from that observed in countries where dogs are the principal carriers.

So far only "external" factors have been discussed, *i.e.*, factors connected with soil or climate or nutrition or the distribution of animals. But, as indicated above, there are "internal" factors, *i.e.*, those connected with the animal itself or with the infective agent, which may also have a profound influence on the spread of a disease. Only the latter type of factor will be mentioned here briefly.

The *virulence* of an organism may vary very considerably. Perhaps the best known example of such variability is foot-and-mouth disease. Usually a mild disease with practically no mortality in adult cattle, it may suddenly appear in a virulent form and cause the death of a fairly large percentage of animals. This happened in 1920 in Europe. The disease had been present in a mild form for some years, and then became more and more virulent.

Virulence and *infectivity* do not necessarily go hand in hand. Panisset has made the interesting statement that sheep-pox is as virulent to-day as it has ever been, but that its infectivity has diminished. A mild disease may spread rapidly, or a virulent disease slowly. But virulence does influence the general complexion of an epizoötic disease, inasmuch as the higher percentage of deaths may provide more "fuel" for the "conflagration."

In some diseases virulence is connected with recognisable *strains* of the infective agent. For instance, in various bacterial diseases it has been found that the virulent strains produce smooth colonies, whereas the avirulent strains produce rough colonies. Sterne has recently confirmed the finding that anthrax is no exception to this rule.

However, in many other diseases virulence does not seem to be a property of any particular strain. The three recognised strains of foot-and-mouth disease virus do not show constant differences in virulence, but each of them may vary independently. On the other hand, in horsesickness some strains are definitely more virulent than others; of the strains used at Onderstepoort the so-called O-Virus is more virulent than the N-Virus and this again more virulent than the Tzaneen-Virus.

With the appearance of a more virulent or a less virulent strain a disease may alter its course completely.

Types of Epizoötics

With so many factors influencing the spread of epizoötic diseases, it is no wonder that their characteristic features vary widely.

The first type may be likened to a *fire* which sweeps through a forest or a prairie and does not cease until all the combustible material has been consumed. This type is illustrated by a disease like rinderpest. We have seen how in southern Africa, for instance, it swept right through the country until the supply of susceptible cattle was exhausted.

Some diseases of this type may sweep through a country in successive waves following on each other at intervals of a few years. The duration of these intervals is determined by the time it takes for a new generation of susceptible animals to grow up. Waves of foot-and-mouth disease have swept through Germany in the years 1892, 1896, 1899, 1911, 1915, 1920, 1924, 1926.

An extraordinary feature of this *periodicity* is the appearance or the disappearance of the disease in different countries at the same time. Thus foot-and-mouth disease after a period of quiescence spread to an alarming extent during the year 1933 in France, Belgium and Holland. In the years following, the number of outbreaks decreased markedly and, in some countries, it seemed on the point of complete eradication. And then in the autumn of 1937 it suddenly flared up again almost at the same moment in Holland, France, Belgium, Germany and England. It appeared as if some unknown epizoötiological factor was operating in all these countries at the same time.

A similar periodicity has been observed in swine erysipelas. In Germany the disease was prevalent in the years 1903, 1906, 1910, 1913, 1916, 1921 and 1924.

The *seasonal nature* of some infections is not quite comparable with the periodicity which has just been discussed. In the former case the diseases appear regularly every year at the same season, and the explanation for this is usually to be found in the influence which the heat of summer or the rainfall or some other factor has either on the causative organism itself or on the vector of the disease. Examples of this nature have already been quoted. One further example may be mentioned: In South Africa the disease known as "sweating sickness" of calves appears every year during the hottest months (January, February and March). Rainfall seems to have no influence on the incidence of the disease. Although neither the aetiology nor the mode of transmission of this disease is known, it is safe to conclude that either (or both) of these factors is dependent on heat, and probably heat only, for its development.

There is a gradual transition from the type of infection known as epizoötic (epidemic) to that known as *enzoötic* (endemic). As a matter of fact, practically any epizoötic disease may become enzoötic. Rinderpest and foot-and-mouth disease, which may be regarded as typical epizoötic diseases, have both become enzoötic in Central Africa, and have probably been enzoötic in Asia for centuries. Frequently (but not always) the process of becoming enzoötic may be accompanied by a reduction in virulence; although this change may be more apparent than real. What often happens is that the reduced mortality in adult animals is achieved at the cost of disease and death in the young. If, for instance, a disease like redwater (Texas fever) or anaplasmosis becomes enzoötic in a country, the young calves contract the disease and many may die; the premunition established in the survivors will protect the animals in adult life; but there will probably be no reduction in the virulence of the original strain.

The question whether, in a country where a disease is enzoötic, the animals will gradually acquire a greater and greater resistance against that disease, is one which needs further investigation. It has been claimed (by Rickmann) that a breed of horses with a high degree of resistance against horsesickness has been evolved by the natives in the Ngami area of Bechuanaland.

Whatever the process of adaptation may be, the fact remains that diseases which have become enzoötic have, in many cases, lost the terror which they inspired in their epizoötic state. This applies particularly to naturally mild diseases like foot-and-mouth disease. In Central Africa very little notice is taken of this disease. And even rinderpest is apparently feared much less than when it first appeared as an epizoötic.

Do Infections Die Out?

Many infectious diseases have, of course, been eradicated by human agency. But the question to be answered at the moment is: can infectious diseases disappear spontaneously? The answer to this question is probably in the affirmative, but it must be qualified. Diseases have disappeared, not perhaps from the globe, but certainly from certain countries. Nagana, which was prevalent in the Transvaal a hundred, and even fifty years ago, has completely disappeared from this Province. In this case several factors probably operated, the chief of which was the wholesale destruction of big game by rinderpest in 1896, which caused the tsetse fly to disappear completely from this part of the country.

Foot-and-mouth disease is another disease which has disappeared spontaneously from South Africa. It may have been present here for a long time previously, but was definitely diagnosed in 1892 and the years following. However, in 1895 or 1896 it seems to have disappeared completely. It is possible that the advent of rinderpest in the latter year may have had something to do with the disappearance of foot-and-mouth disease.

More recently we have seen another disease disappear from South Africa, namely, infectious anaemia of horses. This disease was first diagnosed here in 1914. Various natural outbreaks were recorded and the disease seemed fairly wide-spread. However, for the last ten years or more no trace of the disease has been seen. Probably the conditions were not favourable for the virus or its vector, although the disease seems to flourish in other countries with a climate similar to that of South Africa.

At the beginning of this article reference was made to the origin of infectious diseases. It was shown how the first appearance of a disease like nagana can be explained on the assumption that a state of friendly symbiosis developed between trypanosomes, tsetse flies and game, which was

disturbed only when man arrived on the scene with his domestic animals. Without unduly taxing our imagination we may presume that in course of time the trypanosomes will also adapt themselves to the domestic animals and nagana as a disease will disappear. A similar process can be imagined in many other diseases. But perhaps man with his ingenuity and the application of modern science will have eradicated all these diseases long before such an adaptation will have had time to take place.

Prospects for the Future

No undue amount of optimism is needed to imagine that within measurable time the major infectious diseases will be brought under control. It is said that the first veterinary colleges in Europe were founded (towards the end of the eighteenth century) with the primary object of studying rinderpest. For more than a hundred years veterinary science grappled with this problem until at last practically all Europe was freed of the disease. And when it did appear again in 1920 it was eradicated with surprising ease.

This example may serve to illustrate the remarkable progress which has been made in veterinary science especially since the beginning of this century.

Our mastery over the infectious diseases of our domestic animals depends on our knowledge of those diseases and of the conditions which determine their origin and development. Some of these conditions are beyond human control, but others can be influenced by us. The world looks to us to safeguard the health of our domestic stock and to prevent the misery and desolation which, in the past, followed in the wake of the great epizoötics. We dare not fail in this trust.

Summary

Infectious diseases have been of great economic importance in the past, and still play a great part in the economic life of the community.

These diseases may be introduced into a country in a variety of ways. An infected animal or infected material may be responsible; or the disease may be introduced by a "carrier."

The question is discussed whether new infectious diseases can arise; and it is shown how, through differentiation, a single disease may in course of time, split into several separate diseases. Examples are quoted of apparently new diseases which have appeared for the first time in recent years.

The rate of distribution of infectious diseases may vary considerably. Some remain almost stationary. Those which are transmitted by contact spread at a fairly rapid rate. With modern means of transport, diseases may be carried over long distances. Wars have played an important part in the spread of diseases, many of which may be termed "war diseases." Non-infectious diseases, which are transmitted by arthropod vectors, may also spread over wide areas.

Many factors influence the spread of infectious diseases. The soil may be an important factor in some diseases. Rainfall, vegetation, temperature, and sunlight are very important factors in others. The nutrition of animals also has a great influence on the development of some diseases. Very important, too, is the density and distribution of the susceptible animal population and also the nature and the distribution of the reservoir of the disease.

Factors connected with the infective agent may also have a profound influence on the spread of a disease. Among these factors may be mentioned the virulence of an organism, its infectivity and the strains produced by it.

The various epizoötics present different features. Some sweep through a country like a fire. Others show a distinct periodicity; frequently the periods between successive outbreaks are a few years in duration. Others again appear seasonally, depending on the heat or the rainfall. Epizoötic diseases may become enzoötic, in which case they usually alter their character.

Infectious diseases have been known to disappear spontaneously from a country. The manner in which this may come about is indicated. However, the probability is that, before such a process could come about, man will have eradicated most of the important epizoötic diseases.

Veterinary science has a great task to fulfil in the control and eradication of diseases. It must be our aim to acquit ourselves worthily of this task.

SHIRE HORSE SOCIETY: DIAMOND JUBILEE SHOW

To commemorate the occasion of the Diamond Jubilee show of the Shire Horse Society, which will be held at the Royal Agricultural Hall, Islington, on February 21st, 22nd and 23rd, 1939, the Society have decided to make considerable additions to the prizes in all classes, and a total of £2,200 will be offered. In response to an application from the American Shire Horse Association it has been decided to offer a gold medal for the best Shire stallion and a gold medal for the best Shire mare or filly at the World's Fair to be held at San Francisco next year.

The progressive increase in the number of Shire horses tendered for registration continues. It is reported that 283 stallions and 1,062 mares have so far been accepted for entry in Volume 60, as compared with 252 stallions and 1,024 mares at the corresponding time last year. One hundred new members have been elected to the Society.

The Veterinary Record
October 29th, 1938.

The Loveday Report

THE NATIONAL IMPORTANCE OF VETERINARY EDUCATION

WHAT are the claims of veterinary education upon the public purse? It is manifest that Government has been impressed that it has such claims, for it must have been to investigate them that the Loveday Committee, whose report we have now under review, was appointed. As we have already stated, the members of the committee soon came to the unhesitating conclusion that veterinary education had suffered long neglect, in fact, had been starved. Furthermore, this neglect has been a neglect upon the part of the State, in making even the smallest contribution towards the fostering of this development, at a time when other civilised States had fully realised the enormous justification of its claim to subsidy.

It will be agreed that it is upon the care with which the Loveday Committee have investigated this claim, upon their perception of the possible contribution of veterinary science to the general welfare of this country at the present day and in the immediate future, and upon the precision of their statement of the case thus made out, that basically their report must be adjudged. Unless the committee have presented a thoroughly valid case for State support, it is plain that Government, as guardian of the public purse, would not be entitled to dispose of public moneys for the promotion of veterinary education. In matters of special or vocational education it is plain that it is a duty of good government to differentiate between enterprises or pursuits that ought to be fostered under the especial care of the State and those which are better left, for many reasons that we need not discuss, to private initiative. It is not difficult to appreciate also that all aspects of a particular pursuit or calling may not correspond to those which the State ought rightly to feel bound to promote by subsidy from public funds.

With these elementary considerations in mind we can better appreciate a distinction which the Loveday Committee postulate early in their report. The distinction amounts to the following: Firstly, there is a field of the veterinarian's activities, which has been woefully neglected, which ought to be expanded greatly, which is of superlative importance to the public welfare, and which has an overwhelming claim for State support. Secondly, there is another field, in which it is true, a proportion of veterinarians who are engaged in private practice earn a large part of their livelihood, but which, although no doubt serving in many ways a beneficial purpose, cannot by any sound reasoning expect the support of the State for its development.

It is upon the merits of the distinction thus sharply drawn by the committee that we expect to receive the most vigorous criticism from our veterinary colleagues.

All else in the report must be discussed in the manner of a logical sequence, which can be modified readily in detail without violating the main thesis, provided we accept the fundamental premises, as to what shall constitute the case for State support. All portends that it is upon the extent to which the State meets the case put forward, by coming to the immediate assistance of veterinary education, that the standing of the profession, its usefulness and its whole future will largely depend.

It is enough to say at present that we think the foundations of the report are sound, the distinction to be drawn with entire fairness and, what is still more to their credit, the committee have striven to act upon it—in many places, courageously, but, in some places, we think with unnecessary timidity. But let us discuss the points of view which are likely to affect our judgment in these matters.

Firstly, the activities which have an overwhelming claim to State support. Most opportunely and fortunately, we have been spared the necessity of presenting the arguments which we would otherwise have been compelled to draw up, in similar terms, to support the case put forward by the Loveday Committee. At the Thirteenth International Veterinary Congress recently held at Zürich, the subject of adjusting veterinary education to modern needs came up for discussion as the main topic presented at the General Meeting. In our issues of October 15th and 22nd, we have reproduced, respectively, the addresses of Professor Leclainche of France, and Professor Stang of Germany, in translation, and after a study of these addresses we believe our readers will agree that the words used to express the ripe and great experience of the French and German

authorities are summarised almost precisely in the following short passage, which is the opening paragraph of the first chapter of the Loveday Report:—

"The veterinary practitioner is the physician of the farm and a guarantor of the nation's food supply. His established title of veterinary surgeon obscures his more important functions, which are not only to cure disease among farm stock, but also to check the spread of disease, to eradicate it when established, and by advice on breeding and on nutrition to build up a stock as resistant as possible to disease. . . ."

All that is foreboded of danger to the nation's food from disease among livestock is expounded in the above addresses, as well as in the brilliant survey upon "general conditions in the origin and development of infectious diseases" presented by Dr. du Toit. (*v.* this issue pp. 1468-1476).

Public memory is notoriously short and it is well, therefore, that at this moment thoughtful men such as those whose names we have mentioned should take stock of our present position in the light of our history and indicate as they have done with the greatest clarity and, unwittingly, in full accord with the premises of the Loveday Report the directions in which veterinary education and science generally must be reoriented or re-adapted to meet the conditions of the modern world.

The passage we have quoted from the Loveday Report is indeed no more than a restatement of the ideals of the original founders of the European veterinary schools. The foundational education of the veterinarian must, of imperative necessity, be that of an expert in the whole life economy of the domesticated animal—its breeding, its feeding, its maintenance and its health, all of which are fundamentally inseparable. And yet, for reasons which we need not repeat from the addresses, much of this complicated educational superstructure which ought to have been integrated in the vocational training of the veterinarian, has been appropriated by others outside the veterinary profession who have no such foundational education. As Professor Stang has said, this perversion has never received the approval of the practical breeder and animal owner, who, as we all have reason to recollect with gratitude, welcomes the veterinarian as his real friend. The views of the Loveday Committee are, in these fundamental respects, in entire accord with those of the Lovat Committee, 1928, who took the larger question of our overseas dependencies under their special consideration.

Secondly, the activities which have not such insistent claim to State support. Lest we convey a mistaken impression of the mind of the Loveday Committee, we shall reproduce as it stands the relevant paragraph (5) in their report:—

"In view of the importance of the services rendered by the profession to agriculture and to public health it might have been expected that the State would contribute to the training of its members with at least the same liberality as to other branches of higher education. Actually the schools have been starved, partly because of the conception of the veterinarian as merely a cat, dog and horse leech that still lingers in the predominantly urban consciousness of this country. We do not rest our case for a more generous treatment of the schools on the needs of dogs, cats, hacks, hunters and bloodstock. There are, of course, many dogs necessary to the working of farms, and there are draught-horses not included in the figures quoted above that are needed for industrial and municipal transport. But taken by and large the nearly 3,000,000 companion dogs and sporting dogs licensed annually, the multitudinous cats, and the light horses, while they add to human happiness and represent in total a large capital value, are of private rather than national economic importance. The training of veterinarians to meet their needs may fairly claim generous support from private owners and from sporting organisations. Whilst we do not forget that the veterinarian must give advice on the health and ailments of these animals, yet it is on the national need of securing the health of farm animals that throughout this report we desire to concentrate attention."

Yet, as we have already pointed out, it is from the treatment of the ailments of these animals, other than farm animals, that a formidable proportion of the income of members of our profession engaged in private practice in this country is now derived. Moreover, it is for clinical study of the ailments of these animals, that the schools as they are at present located are largely equipped.

Let us state some of the arguments which support the view contrary to that taken by the Loveday Committee, namely, that the study of these animals other than farm animals is of real national importance:—

(*a*) *Humanitarian.* As was stressed by Youatt in *The Veterinarian* a full century ago, the

veterinary profession is essentially a humane, no less than a utilitarian, profession. To the grievous detriment of our private practitioners, we regret to think that a contrary impression is widely prevalent in the public mind, and at the present time they have often to suffer in their work from the activities of organisations, well-meaning and sincere without doubt, whose avowed object is the dispensation to animals of humane treatment which they consider these animals would not otherwise receive. The only humane treatment of the suffering animal, as of suffering mankind, is that which comes from the bestowal of the highest possible available skill, and to administer treatment with this degree of skill the only services that are to be depended upon are those of the fully trained veterinarian. To a great mass of the British population, who lay store upon their household animals, as their friends and companions, the veterinarian is received, we are happy to think, very much as a "family physician." This great mass may well be excused if they overlook that his title to national recognition is solely that of "physician of the farm."

(*b*) *Psychological.* It would be hard to assess what is the contribution of animals other than farm animals to national happiness and contentment and it would certainly be impossible to assess it in terms of mere money. The real affection of the British peoples for animals is a deep-rooted one and manifested in every social grade and class. Whether they are bred for sport or companionship there is no doubt but that, especially with limitation in the size of human families, animals serve as receptacles or vehicles for human emotions which thus find a happy release. To what extent the kindliness and good temper of the British people is attributable to this phenomenon we do not know. But if these qualities are, as we think they are, in any degree related to this phenomenon, the services of the veterinarian in ministering to these animals cannot be dismissed as of trivial national importance.

(*c*) *Comparative.* It was primarily this aspect of the veterinary art that the "father of comparative medicine," the great John Hunter, had in mind when he became "the life and soul of the movement" to found veterinary education in this country, with the establishment of the London Veterinary College, in 1791. Pasteur himself, whose early work was in the basic sciences but whose later researches were concerned with disease of animals, can well be regarded as an anticipation of the complete modern veterinary scientist. He received, as Professor Leclainche has said, a degree of support from veterinarians in his work which he never received from medical men. More recently still, it was the experience gained by Laidlaw in investigating canine distemper, that when applied to the problem of human influenza quickly provided the solution of its aetiology. Innumerable examples of this kind could be given, all of which would suggest that the study of disease in any and every species of animal may contribute, often most unexpectedly, to the solution of long-standing problems in other animals, including the domesticated farm animals, and even in man himself. Many problems in disease can indeed be better worked out in animals other than those in which the disease calls for treatment. This statement would apply in the case of clinical or therapeutic studies no less than with experimental studies. And, it may well be contended by some that it is far better in the training of the veterinary student, even though he is destined to work among farm animals, to have had the clinical practice which is readily forthcoming from the abundance of small household animals in the large cities than to have had his training in a locality where farm animals were more readily accessible but were available for direct study in insufficient numbers to give him the necessary variety and breadth of experience as a clinician.

This contention has been well answered by Professor Leclainche in his address, and we may well agree with him that too much insistence on the merits of comparative study may cause us to lose sight of veterinary science as an objective study, with definite aims and purpose. In the past, as he says, this insistence has been fraught with unsuspected and untold harm to veterinary education. Nothing has been more harmful, as he stresses, than the misguided insistence of teachers and others that the curriculum of veterinary education could be based on strict comparison with that devised for the training of practitioners in human medicine. It is, to our mind, one of the supreme merits of the Loveday Report that no such comparison is made: we had gravely feared it might have been,

In conclusion, we would reiterate that, subject to the reservations we have made, we are compelled to regard the statement of the case for State support for veterinary education made in the Loveday Report as

essentially sound. It is a case made out in full conformity with the expressions of view of those within the veterinary profession who are held in the highest international repute. It is furthermore the case upon which the veterinary profession itself must base its endeavours to accomplish, urgently, the re-adaptation in training and outlook which is now called for by the conditions of the present day. Our reservations imply that the education of the veterinarian for the treatment of animals other than farm animals cannot be dismissed as entirely unworthy of State support, but these reservations need indeed but strengthen the case advanced by the Loveday Committee.

CLINICAL COMMUNICATION

Successful Treatment of Compound Femoral and Other Fractures, Spaniel

N. R. TURNBULL, M.R.C.V.S.,
BASINGSTOKE

SUBJECT. — Three - month cocker spaniel. Female. Weight 10 lb. 12 ozs.

HISTORY.—Road accident. Preliminary examination revealed fracture of the right femur, upper third, and slight laceration of skin on the outside of the thigh. First seen June 24th, 1938.

TREATMENT.—An X-ray was arranged for June 25th, 1938, and revealed a compound comminuted fracture of the right femur with considerable displacement, also a simple fracture without displacement of the left tibia and fibula. (Figs. 1 and 2.) It was decided to enclose both hind legs in a "cellona" cast.

Anaesthetic—2¾ gr. nembutal intraperitoneally. A plaster cast was made extending from below both hocks and over the hips. The wound was dressed with hydrogen peroxide and covered up owing to the difficulty of making a satisfactory window.

On the following day the dog took weight on both hind legs. Four days later discharges from the wound had so softened the plaster on the right leg as to render it useless, so it was removed and replaced by an extension splint. The cast on the left leg was not touched.

On July 5th both plaster and extension splint were removed. The left tibia and fibula had made a firm union. There was much callus in the right leg but the wound was discharging freely a thickish pus. There were no systemic symptoms.

Four days later the dog was again anaesthetised, same dose intraperitoneally, and the wound explored; a piece of loose bone the size of a threepenny bit was removed. It was noticed that the proximal end of the distal portion of the femur was immediately subcutaneous. On July 10th the leg was screened under the X-ray and it was seen that there was plenty of callus but the distal portion of the femur seemed to be freely movable. The wound was dressed with crude cod liver oil and the skin quickly healed over but still a small sinus was left which discharged a thickish pus.

It was decided to open up again and explore further. The pup had now increased in weight by 3 lb., so the dose of nembutal was raised to 3 gr. intraperitoneally. The wound was opened on July 20th and the previously-mentioned proximal end of the distal portion of the femur exposed. This was grasped with forceps and was found to move up and down like a piston in a cylinder. Gentle traction was applied and a sequestrum 1½ in. long, consisting of the old shaft of the femur, was removed (Fig. 3). The wound was swabbed out and dressed with crude cod liver oil. The next day the pup was livelier than it had been all along although it had been walking on the leg since removing the extension splint.

On July 26th another X-ray was taken (Fig. 4). The wound was now nearly healed. The new callus had completely taken the place of the old femur and was quite dense, and irregular in shape. The action of the dog was normal. On August 23rd a final X-ray was taken (Fig. 5). This shows the new bone beginning to fine down and take on the shape of the original shaft. There is some shortening but there is no apparent abnormality in the action of the dog.

DISCUSSION.—The following points arise from this case:—

(*a*) The age of the pup was undoubtedly a great contributory factor in the healing process.

(*b*) The value of the cellona cast in giving support for a sufficient time for a good primary callus to form.

(*c*) The amazing regenerative power of bone, permitting the formation of what is virtually a new femur and the rejection of the old unwanted shaft as a sequestrum.

(*d*) The lack of deformity.

(*e*) The value of nembutal as a safe and reliable anaesthetic.

Acknowledgments.—My thanks are due to Mr. Knight, M.S.R., for his valuable help in taking the excellent X-ray photographs and to the Committee and Staff of the Basingstoke Hospital for their courtesy in allowing me all the facilities of their X-ray Department.

FIG. 1

FIG. 2

FIG. 3

FIG. 4

FIG. 5

ABSTRACTS

[**Acropachia in the Horse.** Gnoth, V. (1938.) *Dtsch. tierärztl. Wschr.* **46.** 30. 465-470.]

This condition has been most frequently described in the dog.* In the horse, the author was able to find only five recorded cases. Tuberculosis was found in one of these animals, but in the remaining four no cause for the condition could be found. Two new cases are described.

The first occurred in a three-year-old English thoroughbred racehorse which developed a slowly progressive swelling affecting the distal bones of all four limbs following an attack of urticaria. The bones found to be affected at autopsy, eight months later, included the pelvis, distal end of the tibia, radius and ulna, metacarpals, metatarsals, and first and second phalanges. No lesions other than ossifying periostitis were found: the articular surfaces were unaffected.

A three-year-old stallion was received at the clinic suffering from a chronic muco-purulent rhinitis. The reaction with mallein was negative. During the previous five months there had developed a gradual enlargement of the legs affecting particularly the hocks, metatarsals and metacarpals. Cauliflower-like exostoses were found on the affected bones after maceration and histological examination of fixed material showed changes characteristic of acropachia as described in both man and animals.

It is suggested that urticaria with its accompanying anaphylactic effects was responsible for the first case. The second was almost certainly due to the ulcerative rhinitis, since the relation between chronic purulent inflammation and acropachia is known to exist in both man and animals.

E. G. W.

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[**The Nerve Supply of the Extremities of the Horse.** Koch, T. (1938.) *Tierärztl. Rdsch.* **44.** 21. 333-337.]

A description of terminal branches of the ulnar nerve, which have been overlooked by most veterinary anatomists. In the horse the ulnar nerve exchanges some fibres with the lateral branch of the median behind the carpus and then terminates in the interosseous muscle —all except a pair (medial and lateral) of fine filaments which run down alongside the splint bones and at the ends of these become superficial, the lateral branch ending thereabouts and the medial one running down further over the fetlock to end in the pastern. Koch suggests that sensitivity which occasionally persists after high double volar nerve block, may be due to the above nerves, which he names *Nn. metacarpi volares profundi.* Analogous nerves of the hind-leg are described and the corresponding nerve supply in the ox, pig, dog, and man are discussed.

J. E.

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[**A Form of Verminous Ophthalmia in Horses.** Krishna Iyer, P. R. (1938.) *Ind. J. Vet. Sci. and Anim. Husb.* **8.** 1. 3-11.]

The writer describes the clinical symptoms of "periodic ophthalmia" in horses and states that "Cultural examination of the tears collected during the acute stages of the affection revealed a diplococcus and coliform organism only. These organisms and the tears when instilled on healthy eyes of experimental horses failed to reproduce the disease. The same negative results were obtained when these organisms were inoculated subconjunctivally. The possibility of any bacteria or a virus being concerned in the causation of this condition was thus eliminated." With these few words (and apparently experiments) the writer discounts the possibility of the condition being due to a virus or bacteria.

The writer also discusses the incidence of the disease in different studs and the conditions which may be responsible for the variations observed.

Histological examination of the eyes of six affected horses revealed the presence of microfilariae and inflammatory reactions of the conjunctiva and cornea associated with infiltration with eosinophilic and neutrophile leucocytes and lymphocytes. The helminthologist of the Institute reported that "From an examination of the microfilariae and their unsheathed character it appears that the larvae belong to some onchocercoid worm. Specific identification is not possible from the microfilariae seen in the sections."

The writer states that a few eyeballs from healthy horses were examined for microfilariae with negative results. Treatment with Antimosan and other antimony preparations was recommended and is stated to have an inhibitory effect on the progress of the disease.

[The writer in discussing the diagnosis of *Onchocerca* infection during life mentions non-specific tests such as the complement fixation and intradermal tests but fails to consider the simpler and more direct method of examination of the skin for the presence of the microfilariae.

A careful *post-mortem* examination of infected animals, the isolation of microfilariae from the eyeball and their comparison with microfilariae from the more usual habitat (skin

*A case was described by G. H. Wooldridge and J. W. H. Holmes in the *Veterinary Record* of April 24th, 1937 (49. 17. 508-9).

in the case of microfilariae of the genus *Onchocerca*) and microfilariae *ex utero* of any adult females found, should lead to the attribution of the microfilariae to a definite species of *Onchocerca*.

No mention is made of the ocular disease of man attributed to infection with *Onchocerca caecutiens* in South America.]

J. S. S.

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[**First Description in the Netherlands of Parasite in Conjunctival Sac in Ox.** Joling, K. F., and Baudet, E. A. R. F. (1938.) *Tijdschr. Diergeneesk.* **65.** 13. 671-676.]

Joling and Baudet record the occurrence of *Thelazia gulosa* for the first time in Holland in the conjunctival sac of cattle. The latter author gives a morphological description of the nematode and agrees with Kofoid, Williams and Veale, who have recently reviewed the Thelazias of domesticated animals (University of California Publications in Zoology, Vol. 41, No. 17, pp. 225-234), in considering that *T. gulosa*, Railliet and Henry, 1910, and *T. alfortensis*, Railliet and Henry, 1910, are synonymous.

J. N. O.

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[**School of Veterinary Medicine, University of Pennsylvania, Veterinary Extension Quarterly.** (1938.) **38.** 71.]

The bulletin opens with a brief outline of the method of physical examination of dairy cows approved by the American Veterinary Medical Association.

This is followed by a paper entitled "Studies of Recurrent Ophthalmia of Horses." It is mainly concerned with the transmission of the diseases. Details are given of an experiment in which 17 horses were injected (into the eye) with eye material from a case of recurrent ophthalmia. The inoculum had been kept in an electric refrigerator for three and a half months in both a desiccated form and as a filtrate. The desiccated material was injected into seven and the filtrate into ten horses. Of these ten developed lesions indistinguishable from recurrent ophthalmia.

Two cases of spontaneous infection were also studied and when these were killed further transfer attempts were made. The results were discouraging as only three out of 19 injected horses gave typical reactions.

Fourteen horses were injected intra-ocularly with blood serum from a resistant horse and one showed a reaction that might be confused with periodic ophthalmia.

The bulletin also contains a report of a case of swine erysipelas by J. K. Strockbine which was of interest chiefly because this was the first case in the writer's experience.

G. D.

REVIEWS

[**The Anatomy of the Domestic Animals.** (Sisson.) Third Edition revised by Professor J. D. Grossman. 972 pages, 737 illustrations. W. B. Saunders & Co., Ltd., London & Philadelphia. Price 55s.]

Sisson's Anatomy needs no introduction to the veterinary profession, and, as the general plan and scope of the book remain unchanged, little, as regards the actual detail of material, need be mentioned.

Advantage has, however, been taken to introduce the latest developments and most recent observations. These developments, which are naturally of a splanchnological nature, have been observed by the study of well-hardened specimens and frozen sections, and many new illustrations have been introduced on these lines. The value of these observations is not new and was mentioned by Sisson in his preface to the first edition of this book when he says, "The study of frozen sections and of material hardened by intravascular injection of formalin has profoundly modified our views concerning the natural shape of many of the viscera and has rendered possible much greater precision in topographic statements."

Many diagrams illustrating the distribution of the lymphatic system of the ox have been introduced which give a good indication of the complexity of this system; a point not demonstrated in many works in the English language. Few changes are noted in the chapter on neurology, although it is realised that progress in this direction will only be achieved following the co-operation of anatomical and physiological studies. An entirely new feature is the chapter on the anatomy of the chicken, which, although it is brief, contains all the essentials combined with some excellent illustrations and serves to complete the book.

The terminology employed is the same as in the previous edition, although many of the synonyms carried in the footnotes have been dropped.

Finally, it can be confidently stated that all who obtained value from the previous edition will not be disappointed in the new one.

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[**The Pharmaceutical Pocket Book.** 13th Edition. Published by direction of the Council of the Pharmaceutical Society of Great Britain. 1938. Price 5s.]

The fact that this little book has reached its thirteenth edition is itself a strong recommendation. Those whose work entails a knowledge of drugs and dispensing must find it useful, handy, clear and concise. But a glance at its contents shows at once that a far wider field than mere pharmacology is covered. In addition to the

many and varied aspects of pharmacology and its cognate subjects, there are chapters upon the analysis of water, urine, blood, milk, calculi; upon vitamins, endocrinology, food and diet, pregnancy diagnosis, homeopathy, bacteriology, and many other sciences and subjects. Owing to the extremely wide range of its contents, the information about each is condensed and much detail is perforce omitted. The purely pharmaceutical subjects are, however, considered fully, and the information concerning others matters dealt with, is accurate and up to date if not always exhaustive.

A section is devoted to a veterinary posological table. This is fairly complete so far as the standard drugs commonly used are concerned, but we note that many of the more recently introduced substances are not included. We might make the suggestion that when the next edition is prepared the veterinary posological tables should be brought into line with the rest of the book by having them revised.

The book contains an enormous amount of information of different kinds, much of which is not otherwise obtainable without consulting several volumes: it would, accordingly, form a useful though not essential, addition to the veterinarian's reference library.

PIG IMPROVEMENT PROGRAMME: LITTER-TESTING STATIONS

At a recent meeting in London, representatives of the National Pig Breeders' Association and the breed societies, who have been consulted on details of the plan, were informed of the draft proposals relative to a national pig-improvement programme which the Bacon Development Board will shortly submit to the Ministry of Agriculture for approval. Already it is agreed that the scheme be launched next year, under the Bacon Industry Act, by the establishment of two litter-testing stations, in Yorkshire and Gloucestershire respectively, to be supplemented later by stations in East Anglia, the Midlands and Scotland. The cost will be met by the sum of £50,000 made available under the Bacon Industry Act for research and schemes of pig improvement.

"Some details still remain to be settled," states the *Farmers' Weekly*, "but it is understood that the first two litter-testing stations will take 250 pigs each and will thus be capable of testing several hundred litters a year. Modelled on Scandinavian lines, the stations will measure the rate of growth and the quality of animals under standardised and strictly-controlled conditions of feeding and management. Breeders who participate in the scheme will be provided with reliable information on the time taken to bring their "samples" to bacon weight, the amount of food consumed compared with live-weight gain, and the conformation and carcase quality of the finished animal.

"It is thought that the records supplied will provide the breeder with a practical guide in feeding and management, as well as a standard by which he can assess the performances of different pedigree herds. Litter-testing, it is believed, will give a great impetus to pig-recording and should do much to bring a larger proportion of the pig supply up to the standard of quality sought by the curers."

N.V.M.A. DIVISIONAL REPORT

Midland Counties V.M.A.*

MEETING AT STAFFORD

On the invitation of Mr. F. A. Davidson, Divisional Inspector of the Ministry of Agriculture, members of the Midland Counties Veterinary Medical Association held their quarterly meeting at his offices in Stafford, on Friday, September 30th, 1938.

Mr. Davidson, assisted by members of his staff, arranged a demonstration of diagnostic methods in bovine tuberculosis, including the interpretation and application of the tuberculin test, by the intradermal caudal fold and vaginal methods. Another demonstration was on the collection of sputum, and there was a short discourse on the examination of the lungs with the phonendoscope. By special request, also, there was a demonstration of intraspinal anaesthesia in the cow. Afterwards there were demonstrations in the laboratory of the examination of anthrax and tuberculous sputum.

Business Meeting

At the outset, a short business meeting was held. The President (Mr. H. W. Dawes) occupied the chair, and among those present were Messrs. R. B. S. Tuckey, T. Thomson, R. H. H. Over, A. B. Over, J. A. Cormack, T. Bagshaw, J. C. Deville, O. V. Gunning, J. W. Conchie, L. C. Tipper, S. Jennings, H. Tudor Hughes, D. J. Anthony, J. L. Brain, C. J. Peach, R. F. Wilson, A. B. Forsyth, W. B. Burndred, J. H. Findlay, L. W. Mellard, F. A. Davidson, A. S. Caldwell, J. M. McLinden, G. B. Brook, H. McIntyre, J. W. Rollison, J. W. Holmes, P. Richmond, W. H. Brooksbank, W. W. Gregory, R. Dudlyke, J. T. Buckingham, C. H. Lomas and the Hon. Secretary (Mr. A. A. Forsyth).

Apologies for absence were received from Sir Gilbert Barling, Sir Frederick Hobday, Messrs. P. D. Baylis, W. Beddard, T. J. Brain, W. Brooke, J. J. Bucknall, T. Chambers, W. J. Dale, D. Forwell, F. J. Gooch, R. L. Green, T. C. Graves, L. W. Heelis, I. H. Hughes, C. S. Hunting, J. T. Morton, T. H. Hobson, C. F. Parsons, R. L. Phillips, E. Brayley Reynolds, H. S. Reynolds, E. Ringer, J. Robertson, W. Trigger, M. T. Sadler, B. Secker, T. F. Spencer, H. W. Steele-Bodger and T. B. Yarrow.

Nominations for Membership.—The President submitted four nominations for membership of the Association: Mr. J. M. Rorison, Lichfield; Mr. John A. Lee, Tamworth; Mr. W. W. Gregor, Tamworth, and Mr. W. H. Newey, Nuneaton.

*Received for publication October 4th, 1938.

Adrian Jones Statue.—The Hon. Secretary read a letter from Major Dunkin, Secretary to the Committee of the Adrian Jones Statue Appeal Fund, in which it was stated that subscriptions amounting to £76 had already been obtained, with the result that it was now possible to carry out the immediate repairs that were necessary. These repairs were effected by an experienced sculptor artist under the personal supervision of the late Captain Adrian Jones. The committee now wished to make it known throughout the profession that it was now proposed to make this magnificent gift a memorial to the great artist whose work it was, and to bring to fruition his wish that it should find a resting-place somewhere in the grounds of the Royal Veterinary College. For this purpose a further sum of £563 was required, and he invited the Midland Division to add its name to the list of subscribers.

The PRESIDENT said he thought this was an effort with which this Association might show its sympathy. He suggested that a subscription of two guineas would be a gesture which the general body of members would favour.

On the motion of Mr. OVER, seconded by Mr. GUNNING, this suggestion by the President was acted upon.

Poultry Husbandry.—A letter was read from Mr. K. S. Downham, of the Harper-Adams College, offering to help in organising refresher courses in Poultry Husbandry and Disease Control, which the N.V.M.A. wished to arrange for the various Divisions throughout the country.

Mr. TIPPER said the poultry industry was very much on the increase, and promised to be of some importance to the veterinary profession. It might be a good idea to get Mr. Downham to attend a meeting of this Association, and explain the scheme.

The PRESIDENT observed that he was afraid a course of lectures on poultry husbandry would not appeal to many members of the Association. At the same time this was a matter which they could not afford to ignore, because if they turned down the treatment of poultry other people would take it up, which might not be desirable.

In the course of a short discussion several proposals were put forward, one being that the Association might hold a meeting at the Harper Adams College, where Mr. Downham could give them an address with the special facilities which the College had to offer.

Eventually it was agreed to ask Mr. Downham to arrange for a meeting at the Harper Adams College and himself give an address on poultry diseases with special reference to the report of the Poultry Advisory Committee.

N.V.M.A. President.—The PRESIDENT said they would all have noted with much satisfaction that a fellow member of the Midland Division, Mr. Brennan DeVine, had been elected President of the National Veterinary Medical Association. He felt sure thay would like to convey to him their hearty congratulations and good wishes for a successful year of office. No one was more deserving of such an honour and Mr. DeVine had already told him privately that he regarded it as an honour to this Association as well as to himself. He begged to move from the chair that the Hon. Secretary be requested to send Mr. DeVine a letter of congratulation.

This was seconded by Mr. TIPPER and carried unanimously.

Proposed Visit to the Royal Veterinary College.—The Council of the Association, which met earlier in the day, recommended that the next quarterly meeting of the Association be held at the Royal Veterinary College.

The PRESIDENT said he had received a personal assurance from the Principal of the College, and from members of the staff, that a visit by this Association to the College would be welcomed, and they would do their best to make the occasion both interesting and instructive, by staging a variety of demonstrations that would appeal to all of them. It would be a pleasure, also, to inspect the new buildings, and contrast the College of to-day with that of their own student days. His suggestion was that they engage a special saloon on the 11.45 train from New Street on a date to be arranged, and so reach Euston in time to be at the College for a meeting at 2 o'clock.

The feeling of the meeting was in favour of the Council's proposal, and on the motion of Mr. TUDOR HUGHES, seconded by Mr. TIPPER, this was agreed to, the date and the general arrangements being left to the President and the Hon. Secretary after consultation with the College authorities.

Vote of Thanks.—The PRESIDENT moved that the best thanks of the Association be given to Mr. Davidson for inviting them to Stafford and arranging some interesting demonstrations, from which he was sure they could all learn something.

This was seconded by the HON. SECRETARY and carried with acclamation.

A. A. FORSYTH, *Hon. Secretary.*

The British Friesian Cattle Society is to aproach the Minister of Agriculture about the continued importation of Canadian Holstein cattle into Britain. They are not in favour of any policy that might endanger the continued improvement of the British Friesian breed.

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Sheep scab, which was last year said to have been completely eradicated in the Outer Hebrides, has been discovered in South Uist, where over 200 cases have been reported.

Notes and News

The Editor will be glad to receive items of professional interest for inclusion in these columns.

Diary of Events

Nov. 1st.—Meeting of Dumfries and Galloway Division, N.V.M.A., Station Hotel, Dumfries, 2 p.m.

Nov. 3rd.—Annual Dinner and Dance of the Central Division, N.V.M.A., at the May Fair Hotel, W.1.

Nov. 7th.—Meeting of the Editorial Committee, N.V.M.A., at 36, Gordon Square, W.C.1, 4 p.m.

Nov. 10th.—Meeting of the South-Eastern Division, N.V.M.A., at Tunbridge Wells, 3 p.m.

Dec. 8th.—V.V.B.F. (Ladies' Guild) Dance, Princes' Galleries, Piccadilly, W.1.

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PERSONAL

Illness of General Anthony.—As many members of the profession will be aware, and all will greatly regret to know, Major-General W. S. Anthony, Colonel-Commandant, R.A.V.C., has been for some time lying very seriously ill at his home, Knights Close, Woolton Hill, Newbury, Berks. We are very glad to be able to say, however, that General Anthony's state of health is showing some signs of improvement, although his condition still gives cause for much anxiety.

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Gift to the N.V.M.A.—The Association are greatly indebted to Major Hamilton Kirk, M.R.C.V.S., of Finchley Road, London, for the presentation of a chairman's mallet—a handsome antique in boxwood, richly carved, in a satin-wood case—for use at the meetings of the Association, its Council and committees.

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R.C.V.S. OBITUARY

Browning, William James, 7, Foxgrove Gardens, Felixstowe and 14, Museum Street, Ipswich. Graduated London July 29th, 1896. Died October 18th, 1938, aged 63 years.

Mr. W. J. Browning, whose death we record with much regret, was a partner in the firm of Messrs. Castle and Browning, of 14, Museum Street, Ipswich. He had been associated with the business in Museum Street for 38 years past, first with the late Mr. Henry Phillips. Upon the latter's retirement, in 1928, he continued the practice in partnership with Colonel A. F. Castle, a partnership which was joined in September of last year by Mr. R. J. O'Neil, M.R.C.V.S.

The *East Anglican Times* says of him, "Mr. Browning was one of the best-known veterinary surgeons in the county and was highly esteemed, especially among the agricultural community, not only for his professional abilities but also for his charming and engaging disposition.

"During his career, Mr. Browning held several important appointments. He was formerly a veterinary inspector under the Ministry of Agriculture, and up to a year ago, was an inspector under the Diseases of Animals Acts for the Borough of Ipswich. Throughout the war period, he was a member of the Horse Purchasing Board.

"Keenly interested in the 'Suffolk trinity'—Suffolk Punches, Red Poll cattle and Suffolk sheep—Mr. Browning was widely recognised as an authority on the county breeds of stock. He acted as veterinary inspector in connection with all the Red Poll Cattle Society's sales from the time of their inception, and was also veterinary surgeon to the Suffolk Sheep Society. For many years he assisted the late Mr. A. T. Pratt, of Morston Hall, and Mr. Edwin Preston in the selection of Suffolk horses to represent the breed at the national and leading county shows. Mr. Browning was a member of the Royal Agricultural Society, and formerly was a familiar figure at the Suffolk Show, the Woodbridge Horse Show and other local events of a similar character.

"He had been in failing health for some time, and for this reason ceased active participation in the business about 12 months ago and left Ipswich to reside at Felixstowe."

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GENERAL OBITUARY

Lord Daresbury

We regret to record the death of Lord Daresbury—the Rt. Hon. Sir Gilbert Greenall, first Baron Daresbury, of Walton, County Chester—a vice-president of the Royal Veterinary College, who died in London on Monday last at the age of 71 years.

Lord Daresbury was an outstanding figure in the world of pedigree stock breeding and by his death the Royal Agricultural Society (of whose Show he was hon. director from 1906 to 1930) and stock farming generally have lost a staunch and generous supporter. In 1935 the Society paid him a fitting tribute by electing him president for a second time when the annual show was at Chester in his home county. He had previously held the office in 1910. Lord Daresbury's herd of Large White pigs was consistently successful for many years, and the Walton prefix has long been a high recommendation.

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VETERINARY COLLEGE OF IRELAND: EXTENSION SCHEME APPROVED

The Department of Agriculture, Eire, has decided to extend and further equip the Veterinary College of Ireland at Pembroke Road, Ballsbridge, Dublin. For some years back the lack of accommodation and facilities both for the pupils and animals has been keenly felt, and representations have been made to the Department to inaugurate a scheme of improvements which would render the institution more in keeping with its importance to the country.

As a result of the representations to the Department a scheme was drawn up for the improvement of the college. This scheme has been approved, and work on the extension of the college will be commenced in a short time. More accommodation is to be provided for the pupils, and it is estimated that when the work has been completed there will be room for about 200 students. The present entrance in Pembroke Road is to be knocked down and a new ornamental entrance erected, while the plans provide for the provision of a new set of offices.

The staff and students of the college have been handicapped in their research work by an unsuitable clinical department. Under the scheme there is to be an important extension to the existing pathological laboratory, while there will be new operating theatres, new kennels, as well as dressing rooms, waiting rooms and consulting rooms.

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EXPERIMENTAL CENTRAL SLAUGHTER-HOUSES

Announcement is made that the Livestock Commission have appointed Sir Francis Boys (Chairman), Mr. George Dallas and Sir Harold Howitt to be members of a committee to advise the Commission on the technical and financial aspects of the design, equipment and management of experimental central slaughterhouses and of the matters for which provision may be made under a slaughterhouse scheme.

The committee have been authorised by the Commission to co-opt as members of the committee for any particular meeting or meetings of the committee any of the following persons: Messrs. W. Andrews, R. W. Austin, C. Bitterling, D. M. Brown, W. R. Brown, C. A. Coggan, G. H. Collinge, R. Duncalfe, T. H. Gill, C. Hanam, R. H. Hemmings, J. S. Hill, L. A. R. Hill, J. H. Hugon, W. R. Hunter, G. D. Pool, A. W. Ronald, J. G. Sutherland, A. T. Vernon, A. Waddington, J. W. Warren, A. Welsh, N. Williamson, and R. Wood.

The Commission have appointed Mr. W. C. Beard to be secretary of the committee.

[In connection with the above announcement, we wish to inform our readers that a letter has been addressed to the chairman of the advisory committee, expressing the regret with which the N.V.M.A. has noted the non-inclusion of any members of the veterinary profession either on the committee as formed or amongst those to be co-opted for any particular meeting or meetings. The view is strongly advanced that in the consideration of the matters to be dealt with by the committee the advice of members of the profession would be found very helpful.]

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R.C.V.S. CENTRAL LIBRARY FOR ANIMAL DISEASES

Recent acquisitions by the above Library include the following books and monographs:

Bayer Products, Ltd. Fifty years of Bayer remedies. 1888-1938.

Bayer Products, Ltd. Medicine in its chemical aspects. Vol. III. 1938.

Benesch. Veterinary obstetrics. English translation, edited by J. G. Wright. 1938.

Bigger, J. W. Handbook of bacteriology. Fourth edition. 1935.

Hutyra, F., Marek, J., and Manninger, R. Special pathology and therapeutics of the diseases of domestic animals. Fourth English edition, edited by J. Russell Greig. Three volumes.

Horsburgh, D. B., and Heath, J. P. Atlas of cat anatomy. 1938.

Sisson, S. Anatomy of the domestic animals. Third edition, revised by J. D. Grossman. 1938.

Tchaperoff, I. C. C. Manual of radiological diagnosis. 1937.

Twyman, F. Spectrochemical abstracts. 1933-37.

Information about the library services will be found on p. 68 of the Register of Veterinary Surgeons: also a list of the periodicals received in the library.

Library Catalogue.—A printed catalogue of the text-books in the library published since 1900 is available, price 1s., post free. This comprises both an author and subject list, together with an author list of books added to the library between the date of publication and November, 1937. Any further supplementary lists published will be sent free to purchasers of the catalogue.

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"VETERINARY SCIENCE IN THE BRITISH EMPIRE"

Dr. P. J. Du Toit's Broadcast

By courtesy of the speaker and of the British Broadcasting Corporation, we are enabled to reproduce, as we do below, the broadcast address on the above subject given by Dr. P. J. du Toit, Director of Veterinary Services, Department of Agriculture and Forestry, Union of South Africa, in the Empire Transmission programme on October 11th. In this talk, amongst many other matters of moment, Dr. du Toit emphasised very strongly the rightful place of the veterinarian in the social order.

Dr. du Toit said: I wonder how many of you realise the number of veterinary conferences that have been going on in Europe during the last few months. You would have heard much more about them but for the political tension, and I want to tell you something of what was discussed at these meetings. In August, there was an Imperial Veterinary Conference in London. All the Dominions and most of the Colonies were represented, and immediately afterwards an International Veterinary Congress met in Switzerland. In Germany, too, veterinary conferences have been held during the past month, so you can see I have been fairly busy this summer attending these meetings.

Matters of the greatest importance to veterinary science were discussed and substantial progress in all branches was reported. Not only has a vast volume of new knowledge been accumulated in recent years, but it has been found possible to *apply* this knowledge to the improvement of the conditions governing the health of animals and of the animal industry in general.

Animal industry plays a very important part in the economic system of all countries belonging to the British Commonwealth of Nations. As a matter of fact the prosperity and the very existence of many of these countries depend on their animal industry. It is therefore the first duty of the Governments of these countries to make full use of every method at their command to protect and improve the welfare of animals. First and foremost amongst these is veterinary organisation.

I think I can safely say that the general public and to some extent also our legislators do not appreciate how much our countries depend on their veterinary organisations. And yet we need only consider for a moment what the position would be without such an organisation, to realise its value to the State. For instance, Great Britain is free from practically all the major epizoötic diseases. This is not due to chance or good fortune, but entirely to her excellent veterinary services.

The recent devastating outbreak of foot-and-mouth disease on the Continent of Europe again illustrates the need for a well organised veterinary service and its value when organised. In

some European countries practically nothing was done to counteract the spread and to ameliorate the effects of this disease. In these countries the direct and indirect losses were extremely heavy; whereas in other countries where the disease was fought with every available weapon the losses were very much less severe and millions of pounds were saved. Great Britain escaped comparatively lightly from the recent epidemic of foot-and-mouth disease which ravaged Europe. Thanks to her island position, she was able to maintain her policy of rigorous slaughter of all infected herds. The economic losses, although regrettable, were insignificant in comparison with the losses suffered by most continental countries.

At the various veterinary conferences I attended, different methods of fighting foot-and-mouth disease were carefully reviewed and, in spite of recent very notable improvements in the method of immunisation, the policy of slaughtering was still regarded as the most satisfactory wherever circumstances permitted. Great Britain's policy is also the policy of the Dominions, and I am very glad to be able to say that at the moment all the Dominions are entirely free from foot-and-mouth disease. A few months ago South Africa had a few outbreaks, but by applying the slaughter policy courageously and rigorously the disease was stamped out.

Another conclusion which may be drawn from the discussions on this and other diseases is that for a successful campaign you *must* have international co-operation. In this respect the countries of the British Commonwealth have also shown the way. A good example of this is to be found in the campaign which is now being waged in Tanganyika against rinderpest, and in which the Union of South Africa, Southern and Northern Rhodesia and Kenya are also taking part. This may well serve as an example to the rest of the world.

Not long ago the Union of South Africa also sent some officers to the neighbouring mandated territory of South-West Africa to assist their veterinary administration in their fight against bovine pleuropneumonia or lung-sickness which was giving trouble among cattle on their northern border. And only a few days ago it was announced in the papers that the Government of South Africa and the Bechuanaland Protectorate Authorities had agreed on a large-scale co-operative campaign against foot-and-mouth disease in the Protectorate, and these authorities have agreed to examine all the cattle and to discover any focus of infection which may still exist.

It may seem a long cry from veterinary science to international politics, but I should like to hope that co-operation of the kind I have just told you about between Empire countries may lead to similar co-operation between other countries. Then this in its turn may lead to co-operation in other fields of human activity and may contribute in some small measure to a better understanding between the nations of the world.

The countries of the British Commonwealth of Nations are fortunate in having a central veterinary organisation which has been of the greatest value to each of them. This is the Imperial Bureau of Animal Health at Weybridge. The Bureau was established nine years ago and at the recent Imperial Veterinary Conference we reviewed its work and functions. All the delegates agreed that the Bureau was fulfilling a very useful purpose as a central clearing-house of information and that its publications had become an indispensable asset to every library and to every individual veterinarian in the Empire. We also discussed ways and means of improving the Bureau still further and expressed admiration for the efficient and economic manner in which the affairs of the Bureau had been conducted.

Veterinary science in the Empire countries has some notable achievements to record. There are the brilliant researches of the late Sir Arnold Theiler in South Africa in the field of tropical veterinary science; the complete eradication of scab from Australia and New Zealand; the eradication of *dourine* and the remarkable reduction of bovine tuberculosis in Canada; the recent successful vaccination of horses against horsesickness in South Africa and many other individual achievements. All these have assured these countries of an honourable place in the annals of veterinary science.

But although we may justly be proud of these past achievements, we have every reason to expect much more in the future. Veterinary science is at last coming into its own and is gradually receiving the recognition and support which it deserves. In Britain both the Government and the public have shown their appreciation of the excellent work that is being done by donating generously towards the rebuilding of the Royal Veterinary College in London; and London can now claim a truly magnificent college. In other centres in Britain rapid progress and expansion are also taking place. At the many research stations and colleges a large volume of splendid work is being carried out.

The same applies to the Dominions. In Australia, New Zealand and Canada, great progress has been made in recent years and the veterinary problems of these countries are being tackled and solved at a very satisfactory rate. In East Africa, at Kabete, a very fine veterinary research station has been built and is continuously being extended. Here in the heart of tropical Africa, practically on the Equator, there is a very competent team of research workers, and they are doing work of first-class importance to all tropical countries. The work now being done at Kabete may well play a decisive rôle in the future development and destiny of the British possessions in Tropical Africa.

Of the work which is going on in South Africa I can speak from personal experience. At Onderstepoort, near Pretoria, the Government, 30 years ago, established a Veterinary Research Institute under the directorship of Sir Arnold Theiler. That Institute has brought untold benefits to the farmers of South Africa and has been responsible, more than any other single factor, for the rapid expansion of the animal industry in that country. There is now no animal disease of importance and no major problem connected with the health of animals which has not been investigated at Onderstepoort. In the majority of cases help has been rendered to the stock owners. If to-day anyone suggested closing down Onderstepoort there would probably be a revolution among the stock farmers of South Africa. Even beyond the borders of South Africa the work of Onderstepoort is well known and appreciated. It is indeed very gratifying to attend these international congresses and to hear the many appreciative and complimentary things which are said about the work already done and still being done there.

All the congresses I attended made one thing particularly clear, and that was how much veterinary science had advanced in recent times. No longer the Cinderella of sciences, veterinary science can to-day proudly claim her place in the front rank of the biological sciences. Both in theoretical research and in practical adminis-

tration the veterinarian has conquered his just place. He still needs and welcomes co-operation with scientists in other branches of biology, but he refuses to admit that veterinary science is in any way subsidiary to or dependent on the sister science of human medicine or the allied science of agriculture. Veterinary science has *come of age* and wishes to be treated as a separate branch of learning.

There is one field in which the veterinarian has to co-operate closely with the public health officer on the one hand and the agriculturist on the other. And that is in the supply of clean, healthy and wholesome food to the population. Now that the world has become nutrition-minded, it is essential that the veterinarian should take his rightful share in controlling the nation's food. We must look to the veterinarian to control and protect the health and the hygiene of our dairy cows; to inspect our beef, mutton and pork supplies both before the slaughter of the animals and after; to look after the health of our poultry; and to supervise such other foodstuffs as fall within his domain. In carrying out these functions the veterinarian performs a truly national duty.

So far as I can see the standard and the achievements of veterinary science in each country depend on its status *in that* country. Where veterinary science is independent and enjoys the full confidence of the authorities, there its achievements rank high. But where it is regarded as an appendage to medicine or agriculture, has no independent status, there its achievements are lower.

It is to be hoped that the countries of the British Commonwealth will take the lead in giving veterinary science the recognition which it deserves and that their stock farming communities will reap the benefit that would result.

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CORRIGENDA

"Changes in the Names of Worms: The Rules of Zoological Nomenclature as applied to Veterinary Helminthology." By Dr. J. N. Oldham.

The Veterinary Record, Vol. 50, No. 36, pp. 1131-1138. September 3rd, 1938.

Page 1133 Right-hand column, line 38, delete full-stop following (Rivolta, 1884)

Page 1133 Right-hand column, line 42, delete full-stop following (Schrank, 1790)

Page 1134 Left-hand column, line 5, for Mehl., 1831) read (Mehl., 1831)

Page 1134 Left-hand column, line 9, for *Anoplocephaloides mamillana* (Mehl., 1831) read *Anoplocephala perfoliata* (Goeze, 1782). This last name is generally accepted as correct, is not a synonym, and should therefore commence at the extreme left of the column.

Page 1134 Left-hand column, line 24, delete full-stop following (Bloch, 1779)

Page 1134 Left-hand column, line 16 from bottom, for *Moniezia pelucida* Bleis., 1920 read *Moniezia pellucida* Blei, 1920.

Page 1134 Right-hand column, line 18, for (Batsch. 1786) read (Batsch, 1786)

Page 1134 Right-hand column, line 27, delete full-stop following (Tschudi, 1837)

Page 1135 Left-hand column, line 24 from bottom, delete full-stop following Schneider, 1866

Page 1135 Right-hand column, line 20, for *Diesing*, 1851, *e.p.* read Diesing, 1851, *e.p.*

Page 1135 Right-hand column, line 44, for (Linstow, 1007) read (Linstow, 1907).

Page 1136 Left-hand column, line 34 from bottom, delete full-stop following (Frölich, 1791)

Page 1137 Right-hand column, line 15, for Molin, 1861, e.p., read Molin, 1861, *e.p.*

. . . . .

Mr. Steele-Bodger writes drawing our attention to an error occurring in the report of his remarks at the meeting of the Society of Veterinary Practitioners held in Birmingham on July 15th. In the following sentence: "If it had been possible to get the Ministry to agree to those things (emergency duties) being done by a whole-time staff of Panel A men, and all non-emergency treatment left to Panel B men, we should have been better satisfied," *for* "whole-time" *read* "part-time."

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NATIONAL HORSE ASSOCIATION

The Council of the National Horse Association, at their last meeting, learnt with pleasure that the Earl of Athlone, K.G., would honour the Association by acting as its President in 1939.

Lectures on Equitation.—The Council approved of the suggested lectures on equitation. The arrangements already made had unfortunately been held up, but the first three lectures and practical demonstrations would shortly be held in the evening at some covered riding school in London. Dates would therefore be sent to all interested. Briefly it was proposed to have the following lectures and practical demonstrations: Major H. Faudel Phillips on "The Early Steps Leading to Advanced Equitation," Captain J. E. Hance on "Advanced Equitation," and Captain R. B. Sheppard, of Weedon, on "Jumping." Later there would be lectures by Mrs. Archer Houblon on "Side Saddle," Mr. James R. Hewer, M.R.C.V.S., on "Elementary Veterinary Science," Miss O. Eldon Pratt on "Saddlery," and Mr. Horace Smith on "Driving," etc.

Driving.—It was reported that requests had been received for the arrangement of semi-social fixtures for members interested in driving, and therefore it was hoped to arrange for at least two meets and drives next summer, when members would meet and drive to horse shows. The meets would be restricted to road vehicles belonging to members, but trade vehicles would not be accepted. No prizes would be offered, but souvenirs would be given to each driver taking part. As soon as arrangements had been completed, full details would be sent to members, and it was hoped that all interested in driving would participate.

Licensing of Stallions.—A letter had been sent, it was stated, to all Horse and Pony Breed Societies asking for their views in regard to a

proposal which had been suggested during the summer, that all stallions—those standing at stud as well as the travelling stallions—ought to be licensed under the Horse Breeding Act. So far only four replies had been received, as apparently the majority of the Horse Breeding Societies had not yet had their meetings. These all indicated that they considered the present scheme quite adequate, but after a very interesting discussion it was decided to consider this matter at the next meeting, by which time it was hoped that all Breed Societies would have sent in their views.

Horse Trailers.—The Ministry of Transport desire to call the attention of owners of horse box trailers that under new regulations the owner of a motor horse box trailer which is fitted with over-run brakes, must have the unladen weight of the trailer painted or otherwise plainly marked upon some conspicuous place on the left or near side of it. This regulation applies to all trailers irrespective of the construction or the use to which the trailer is put. It was resolved to notify members through the quarterly news sheet, and to express the hope that the horse and agricultural Press would also mention this fact in their columns.

Horse Owners' Reference Book.—The Secretary was instructed to proceed with the compilation of the 1939 edition, and it was hoped that the dates of all shows and sales fixed for next year might be sent in to the Association so that a reference might be made to them. The Council noted with pleasure the large increase in circulation.

Examinations for Riders.—The Council approved of the very thorough way in which the committee now considering the holding of examinations and issue of certificates for riding was investigating the whole position all over the country, and directed them to report as soon as possible.

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OPENING OF THE McGARVIE SMITH ANIMAL HUSBANDRY FARM

Professor J. D. Stewart on Its Value to Veterinary Education and Animal Husbandry

We publish below the address given by Professor J. Douglas Stewart, F.R.C.V.S., B.V.Sc. (SYD.), Dean of the Faculty of Veterinary Science, University of Sydney, New South Wales, at the official opening of the McGarvie Smith Animal Husbandry Farm, Sydney, on September 8th, 1938. The address constitutes an excellent résumé of the place a farm can play in veterinary education and very much of what was said applies equally well to us in this country.

Professor Stewart said: In the curriculum of the Faculty of Veterinary Science, Animal Husbandry is a very comprehensive subject as it not only deals with the care and management of all classes of livestock but it embraces the many aspects of animal production and includes systematic instruction in breeds and breeding, feeds and feeding, and the market requirements for milk, beef, mutton, fat lambs and wool.

The importance of Animal Husbandry to a country depending so largely upon animal products for its revenue as Australia does, needs no emphasis to a gathering such as this, but one may be permitted to stress the fact that maintenance of our national prosperity will be influenced not so much by increasing our flocks and herds as by improving quality and reducing cost of production, so that our products may successfully compete with the best of other countries at a price acceptable to the consumer. In this manner existing markets can be developed and new markets created on a permanent basis, and advancement along these lines urgently calls for the application of scientific knowledge and the prosecution of research. It is precisely in this connection that the McGarvie Smith Animal Husbandry Farm will prove a valuable asset not only to this State but to the whole of Australasia, since students of the Sydney Veterinary School come from all States in the Commonwealth as well as the Dominion of New Zealand, as it will provide additional facilities for the more complete training of veterinarians—the officers to whom stock-owners look for guidance in the adoption of modern methods.

While the location of the Sydney University Veterinary School within the University grounds has many inestimable advantages, it does not provide opportunities for students to gain requisite experience in certain branches of animal husbandry. To make good this shortcoming it is our practice to hold demonstrations at various shows, studs, dairies, etc., within the metropolitan area, and to take certain classes each year, by permission of the Department of Agriculture, to the Hawkesbury Agricultural College during vacation periods for practical instruction under their lecturer; we are much indebted to the Principal of the College for his sympathetic assistance in this regard. In addition all students are required to produce before sitting for their final examinations evidence of having spent at least six months in gaining further practical experience. These provisions have undoubtedly proved helpful, but it must be admitted that they do not supply all that is desired. The establishment of the McGarvie Smith Animal Husbandry Farm will definitely remove our difficulties in this connection, as all students will now enjoy full opportunities to become proficient in this important branch of their training, and as Dean of the Faculty of Veterinary Science, I desire to express on behalf of the Faculty our eternal gratitude to the University for acquiring the farm and to the trustees of the McGarvie Smith Institute for the financial assistance so generously granted to us.

The farm, which comprises 400 acres, has been cleared and subdivided into convenient paddocks. Four large dams have been constructed to conserve water, a reticulation system installed, and a number of tanks and drinking troughs erected. About 200 acres have been cultivated and the crops grown have been conserved as hay, silage or grains. Both tub and pit silos are being used. Some 30 acres have been laid down as a permanent pasture, and in the course of time the whole of the pastures will be improved. In addition, a number of buildings and yards have been erected. The building in which we are assembled provides comfortable quarters for some 30 students at one time as well as for members of the staff, and you will see during the tour of inspection the residence of the farm manager, the dairy and milking bales, bull paddocks, calf house, piggery, stables, barn and machinery shed. In connection with the general lay-out of the farm buildings and yards we have been fortunate in

having the valuable assistance of Dr. Kelley, officer-in-charge of the F. D. McMaster Research Farm, who has had extensive experience in these matters.

To provide the requisite training, flocks and herds will gradually be acquired. A start has been made with a dairy herd of some 20 odd Jersey cows and heifers carefully selected for production and tested free from tuberculosis, mastitis and contagious abortion. Sir Archibald Howie kindly presented us with a cow and heifer of the famous Yaralla Stud as a nucleus and has also placed at our disposal one of his pedigree bulls. Other cows and heifers have been obtained under favourable conditions from the Kamerooka Estate, specially selected for us by Mr. Taylor, and the remainder of the herd was purchased from Messrs. Brown Bros.' well known Wollingulla Stud. For our piggery, Sir Frederick Stewart has presented us with three pure bred Tamworths which will be used for crossing with Berkshires. A number of active farm draught horses and several hacks have been purchased, mostly mares to be bred from. The poultry unit has not yet been built. For instruction in sheep and wool the flocks of the F. D. McMaster Research Farm are to be made available.

In order to obtain the desired degree of co-operation by instructors and proper co-ordination in the instruction given, the work of the farm is to be controlled by a Board of Farm Studies, consisting of the Lecturers directly concerned together with the Officer-in-Charge of the F. D. McMaster Research Farm and the Chief Veterinary Officer of the Department of Agriculture. Dr. Carne has acted as Secretary to this Board and relieved me of most of the routine work in connection with the establishment of the farm. In fact the enthusiasm he has shown would seem to indicate that he has adopted the farm as a special hobby.

Students will go into residence at the farm in convenient groups up to 30 in number during vacation periods and at week-ends under the control and direction of responsible university officers, and will also have special demonstrations by experts in particular branches of their work. Each group will be divided into four main sections, namely, dairy and piggery, horses and stables, sheep and wool, farm work and pasture improvement. The training the students will receive will supplement the lectures given in the classroom and will be definitely of a practical nature. It will include milking both by hand and machines, testing, recording, interpretation, rationing for production, grooming, harnessing, riding, driving, horse-shoeing, mating, lambing, marking, dipping, jetting, shearing, crutching, wool sorting, fertilising and pasture improvement.

In this manner the students will have exceptional opportunities to acquire sound knowledge in all branches of Animal Husbandry.

In connection with this training there will be an active co-operation with the staff of the F. D. McMaster Research Farm, and much importance is attached to the assistance Dr. Kelley and his staff will render.

Advanced students will also benefit from a close association with the investigations being carried out under field conditions by the McMaster Laboratory of Animal Health of the Council for Scientific and Industrial Research, and the close co-operation which exists between the Veterinary School and the McMaster Laboratory will be thus further strengthened. Final year students will also profit greatly by being able to add to their training in obstetrics, as there is a large population of dairy cows in this district.

The official opening of this farm marks the realisation of a long-cherished desire much to our gratification, and the fact the farm has been named to perpetuate the memory of an old friend of many present to-day, who was largely instrumental for the vaccination of our flocks and herds to protect them from the ravages of that fell disease anthrax, makes the realisation more pleasing. In the absence of the Vice-Chancellor, I have much pleasure in asking Mr. James Kidd, Chairman of the McGarvie Smith Trust, to declare the farm officially opened.

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HORIZONS IN ANIMAL PRODUCTION

"The discussion on animal production in Section M (Agriculture) of the British Association at Cambridge on August 23rd had one excellent result: it demonstrated very clearly indeed the inseparableness of the three main constituents—animal husbandry (the feeding and management of livestock), animal breeding and disease-control," writes Joseph Edwards in *Nature*, September 17th.

"Gone, it would seem, are the days when the animal nutritionist claimed that feeding was more important than breeding; or the geneticist, that breeding was more important than feeding; or the animal pathologist, that control of disease was a laboratory problem divorced alike from heredity and husbandry. This is not to say that specialists in each of the three fields have, so far, been wasting their time, for there is plenty of evidence to show that in explaining and improving existing practices they have done very necessary work. The animal geneticist, for example, although he has been unable to direct the emergence of strikingly new and improved types of livestock, has been able to interpret the mechanisms of heredity, to define the prerequisites for successful in-breeding and to examine the significance of mutations.

"There is, too, the welcome sign that no longer is a specialist in one field prone to dismiss an unsolved problem by deciding that the solution lies in another field; the time has come when further advance can be hoped for only by co-operation and by studying the animal as a creature living in a given environment, and in relation to the demands made in it by society.

"The separation of the problems of animal production into those requiring immediate attention and those that can be dealt with only on a long-term basis can easily be made. Into the first category come measures for disease-control and measures for increasing efficiency of production through improvements in feeding and management already established but not generally adopted. Professor R. Rae believes that in recent agricultural legislation (the Agricultural Act and the Livestock Industry Act, both of 1937) there exists the machinery for immediate improvement in both spheres if the interpretation of the Acts is courageous and intelligent. This is especially the case where the organisation of producers for marketing purposes provides also the organisation for stimulating improvement in the quality of the produce. For example, without the Milk Marketing Board, the guaranteed extra payment for milk from herds free from tuberculosis would be impossible. This

payment is already acting as a considerable incentive to the eradication of tuberculosis. As Dr. J. Hammond pointed out, it is much wiser to pay producers to improve their business in this way than, as in the past, to allow them to rear diseased stock and to earn compensation by slaughtering it. The question of food supplies for animals in the event of war is also a problem of the present: in this connection, the newer methods of making silage from our grassland merit attention.

"The problem of disseminating the results of research is to-day as important as any problem requiring research. The gap between the enlightened practice of the few and the mediocre practice of the many worries all who observe it. It is admittedly a problem affecting the whole of farming practice and about it Professor R. G. Stapledon had much to say. An improvement in rural education is of first importance so that farm labour may be recruited from the ranks of the best rather than from those who are left when the brightest have migrated to town jobs. The rural schools recently started in Cambridgeshire and elsewhere aim to solve this problem; and if those leaving school could begin a definite apprenticeship on the land (as suggested by Professor Rae) the quality of farm labour could be raised to meet the more specialised requirements which it must now fulfil.

"For the present, there is hope of improving the efficiency of production by the spread of quite simple schemes (of which the 'food-recording' schemes for pigs and dairy cows are examples) that provide very valuable yard-sticks. The producer is not given an abstract counsel of perfection; he has his enterprise—his herd of pigs or milking cows—carefully costed for him and, with the help of a skilled superviser, is able to compare his ability as a manager of livestock with that of his neighbours and to discover directions for improvements. Producers grouped into marketing organisations with monopolistic powers are under a moral obligation to the State to make such schemes general.

"The material in a paper on animal diseases by Dr. E. L. Taylor provides a convenient bridge for crossing from the problems of immediate importance to those of the future. It illustrates, too, the nature of the new approach. In the past there has been a tendency to study all diseases in a pathological laboratory, but Dr. Taylor defined disease as a 'flaw in the environment.' Dealing chiefly with the worm parasites (which cause enormous loss and are of special importance to the sheep industry) he showed the close relation between the health of the animal, its environment and its tolerance of parasites. For example, the age of the animal and its plane of nutrition are important factors; young growing sheep do not have the resistance of mature sheep, and under-nourished mature sheep quickly lose their tolerance. A sheep may pass as many as 200,000 worm eggs and be in normal health; if its constitution is reduced (for example, by poor nutrition) the number may increase to 9,000,000 per day. The circle is vicious: pastures became infested and all sheep suffer. While in rare cases specific medicines may effect cures for such a 'disease,' there is the much simpler and cheaper cure of good husbandry. Improved pastures and rotational grazing provide a better plane of nutrition, and another species of livestock—cattle, for example—not susceptible to sheep parasites can be employed to clear up sheep-grazings.

"In human medicine, the part played by improved housing, sanitation and nutrition in eradicating disease is now generally recognised. In animal production it is certain that improved methods of feeding and management will yield comparable results. The hope is real that the new State Veterinary Service will provide veterinary husbandmen rather than veterinary pathologists.

"The futures of animal nutrition and animal genetics are going to be closely related to the prosecution of anatomical and physiological research. Almost all applied problems can be resolved into terms of the anatomy and physiology of relative growth, of reproduction and of endocrinology. It may seem a far cry from these to society's demand for small succulent joints of meat, rashers of bacon with the right proportion of muscle to fat, eggs of satisfactory weight and milk of better quality or to the desire of the producer to breed and feed livestock that will meet these demands and yet remain fit and profitable; but the connection exists. In the field of meat production, Dr. Hammond has shown the great possibilities of altering the proportions and quality of the carcase by varying the shape of the growth-curve. Even in closely in-bred animals of a pure breed, an astonishing flexibility in their response to varying planes of nutrition has been demonstrated. This exploitation of the animal as it grows promises great advances over the old methods of measurement of "live-weight gain per unit of food consumed." Professor F. A. E. Crew maintains that it is this flexibility (or "degree of modifiability" as he calls it) which must be established for our existing breeds and types of livestock before the geneticist can play his full part.

"The importance of further research in the physiology of reproduction is emphasised by the incidence of sterility in livestock, much of which is certainly not pathological, and by the economic need of maintaining and increasing fertility. In this field the use of sex hormones is bound to play a large part—Professor Crew's forecast of the syringe replacing the seasons is apt. The work at Reading on the lactogenic hormones indicates great potentialities in the sphere of milk-production.

"The discovery of a new technique is usually of fundamental importance, and that of artificial insemination is no exception. The improvement of the quality of livestock in Great Britain is greatly hampered by the small size of the breeding units. For example, one half of the quantity of 'wholesale' milk dealt with by the Milk Marketing Board comes from herds containing ten cows or less. The owners of such small herds cannot afford to buy a sire of adequate merit, and in fact the majority use non-pedigree animals. The result is that much of the home-bred stock is unsatisfactory and new stock has to be purchased. This practice, besides being most inefficient, often is responsible for the introduction of disease. Through the development of artificial insemination, there is the prospect that the small herd may benefit from the use of sires at present confined to the larger herds, where their services are far from being fully expoited.

"The evolution of breeds of livestock existing to-day has been directed by breeders working closely with a constantly improving environment and to a definite purpose. There is every indication that the process can be continued and accelerated, and that more can participate in it."

Correspondence

Letters to the Editor should reach the Office not later than by the first post on Tuesday morning for insertion in following Saturday's issue.

All correspondence must bear the name and address of the contributor for publication.

The views expressed in letters addressed to the Editor represent the personal view of the writer only and must not be taken as expressing the opinion or having received the approval of the N.V.M.A.

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INVIDIOUS DISCRIMINATION

To the Editor of the Veterinary Record

Sir,—I have read the report of the Committee on "Veterinary Education in Great Britain" (why only Great Britain?) with interest and while considering it to be very modern on the whole it seems rather ancient and perhaps classical in some respects.

On page 78 it is suggested that the schools should give preference to country boys as accepted students. I went to five schools in my time and mixed with youths drawn from all parts of the British Isles and Ireland, but cannot assert from my experience that the country boys covered themselves with glory and great prominence either in work or play. Many of them were good fellows but slower intellectually than the town men and eventually most of them left the country and found occupation in the town. Probably Shakespeare had in mind the country boy when he mentions "the schoolboy with his satchel and *shining morning face*" (the result of country air) "creeping like snail unwillingly to school." Quite recently a report on a country boy by a schoolmaster finished up with "rather dull, would make a good parent."

The report seems to ignore the ever-increasing tendency of the country youth to migrate to the towns. The position of many farmers is not financially good enough to enable them to send their sons even to veterinary colleges let alone Universities. Agriculture has been badly let down by more than one Government and even now there is more pity than help given to it by politicians. The report, too, seems to overlook the fact that not a few farms exist through the efforts and finance of many town men. Again, some town men even keep horses, cows, sheep and pigs, to say nothing of poultry, on the borders of towns or even in the towns themselves, and I have known no small number of men who have qualified as veterinary surgeons that have been recruited from these circles and whose entourage and bringing up have enabled them to do quite well as veterinary surgeons and not even to neglect the science of husbandry about which there is so much talk at the present time.

Yours sincerely,

G. Mayall.

Bolton.

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TREATMENT OF EQUINE COLIC

To the Editor of the Veterinary Record

Sir,—I was interested in Colonel Rainey's criticism of my paper on "A Few Notes on Equine Colic." He takes me to task on three points:

(1) Using a preliminary dose of oils, aloes and anti-spasmodics.

(2) Omitting to use controls.

(3) Omitting the humanitarian aspect and using arecoline.

I am of opinion that apart from the immediate relief the preliminary dose of oil and anti-spasmodics often gives to the animal, this treatment is justified for its parasitic value alone, as one cannot dissociate strongyloses from colic. The late Mr. Noel Pillers used to say that colic cases which had had plenty of ol. tereb. were invariably free from strongylosis infection.

With regard to the second point, Colonel Rainey asserts that without controls all the claims for the cure of colic by medical means are baseless. He follows by making some very definite statements on points of treatment which are, to say the least, controversial. In view of what he has to say on clinical licence, and the infusion of science into our practice, one naturally expected something scientific from Colonel Rainey, but not in one single instance does he offer any concrete proof for any one of the statements he puts forward.

Regarding the humanitarian aspect of colic, I would remind Colonel Rainey that the sole object of my paper was the advocacy of a substitute for arecoline and eserine by a hormone normally present in the bowel wall, and to my mind there can be no more reasonable or humane method of attack. Why Colonel Rainey should object to hastening the end of an animal doomed to an agonising death, I am at a loss to know, especially when chloral or atropine (both of which I carry in my equipment) or any drug I know of will not relieve an animal suffering from severe displacement. It appears it is only when, towards the last, the toxins have partially paralysed the nerve endings, that relief sometimes comes to the patient. Further, destruction is usually out of the question due to the opposition of the owner and also from the fact that occasionally apparently hopeless cases make a spectacular recovery.

In view of Colonel Rainey's assertion, quoted earlier, that without controls any claim for the cure of colic is baseless, he cannot logically expect me to accept his sweeping statement that all animals will recover whether given drugs or not, without supplying the necessary proof. This is surely the worst form of clinical licence. A proportion undoubtedly would recover, but I am convinced that there are many cases of impaction of the small bowel, where on *post-mortem* examination there is no evidence of twist, and as early treatment is essential, who is to say which cases will or will not recover? Are we to attend a horse which we know to be badly impacted by merely giving a sedative dose without any attempt to remove the cause?

I would respectfully sum up Colonel Rainey's letter in his own words: "What a confession of ineptitude." After his years of rich experience he can offer nothing better than to give a dose of chloral and hope for the best, and, what is worse, he is still willing to wait for some definite proof. I fully appreciate and admire Colonel Rainey's humanitarian outlook and also his courteous criticism, but I am far from convinced that his passive policy is in the best interests of the animal.

Yours faithfully,

O. V. Gunning.

Tutbury,

Burton-on-Trent.

October 14th, 1938.